THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CIX. No. 2439.] LONDON, FEBRUARY 8, 1910. [62ND YEAR. PRICE 6d.

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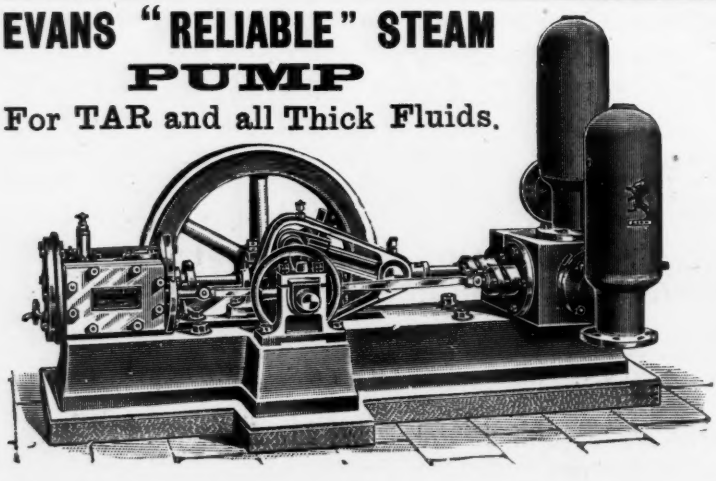

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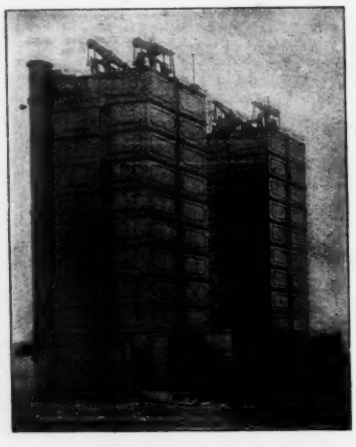

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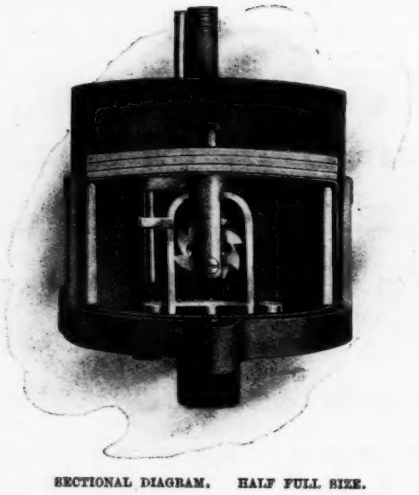

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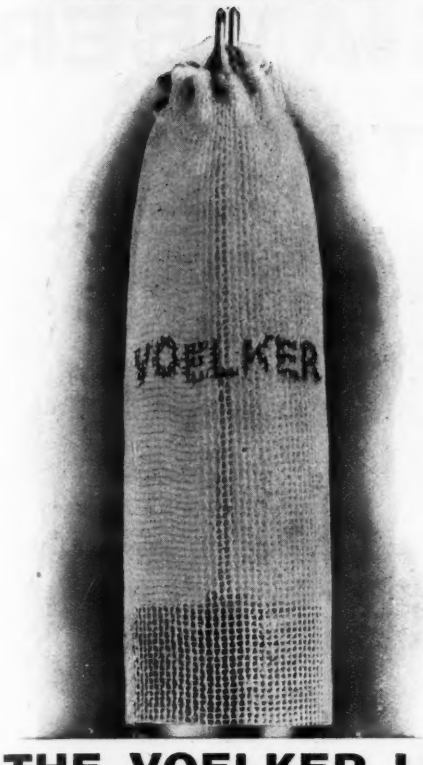

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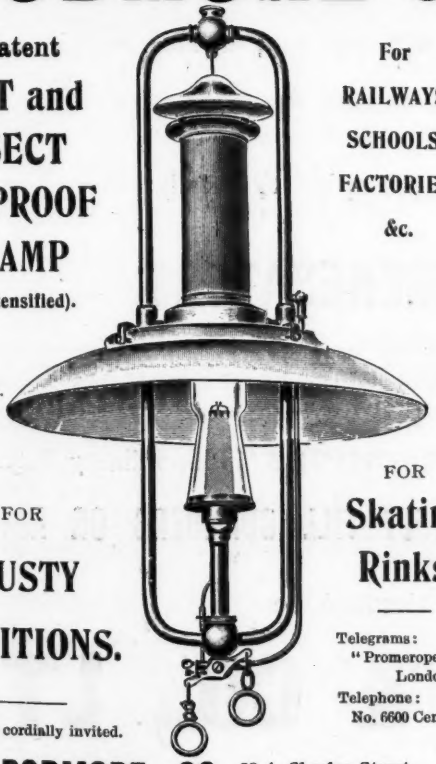

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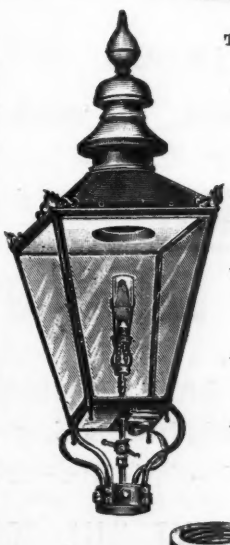

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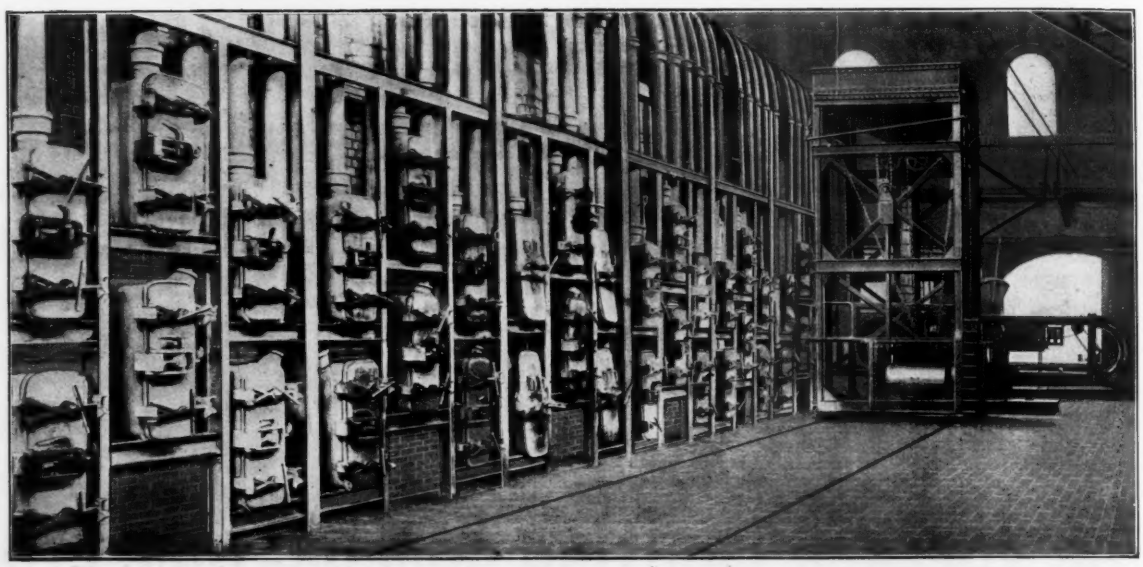

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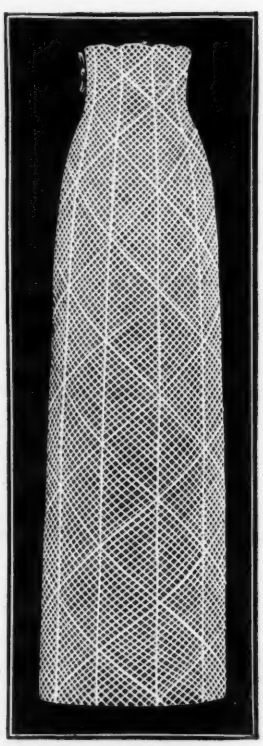

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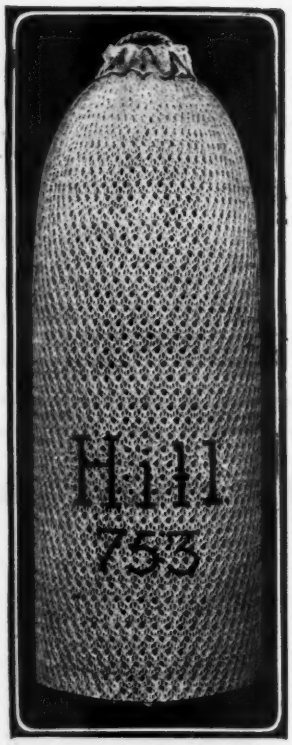

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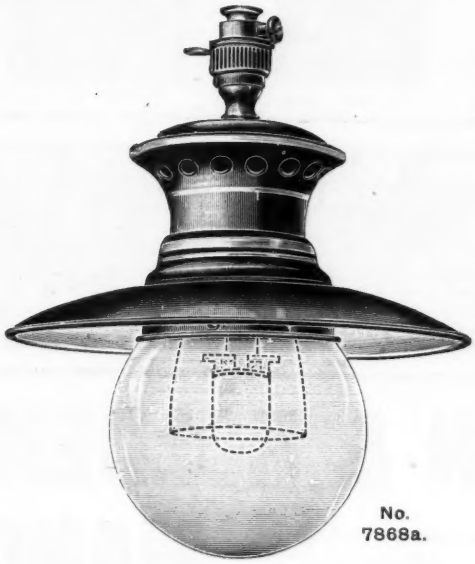

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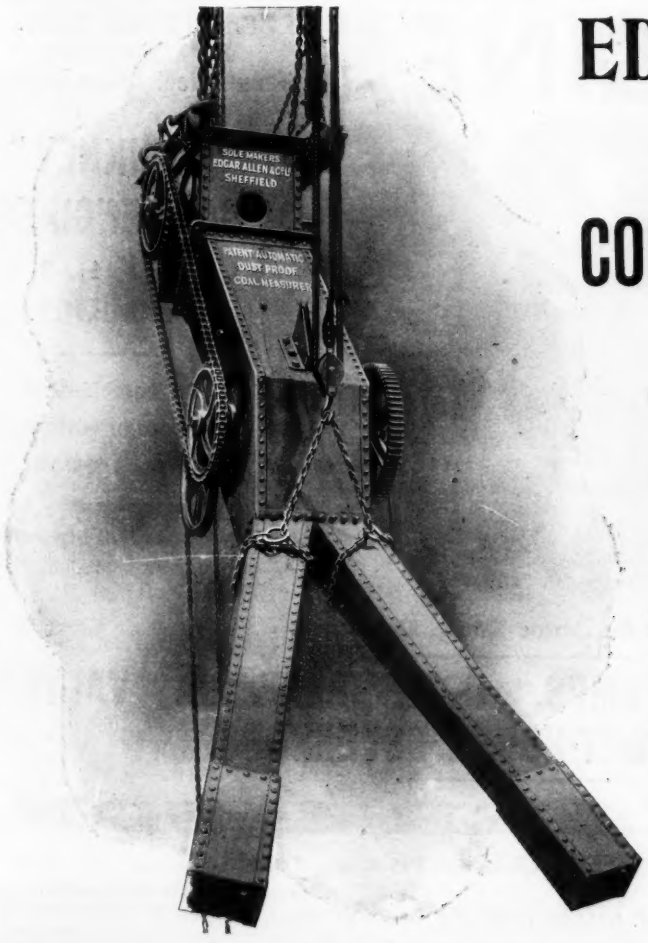

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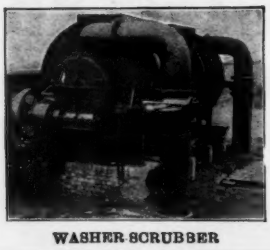

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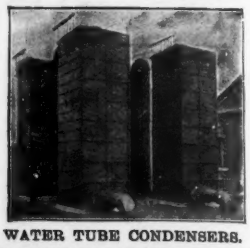

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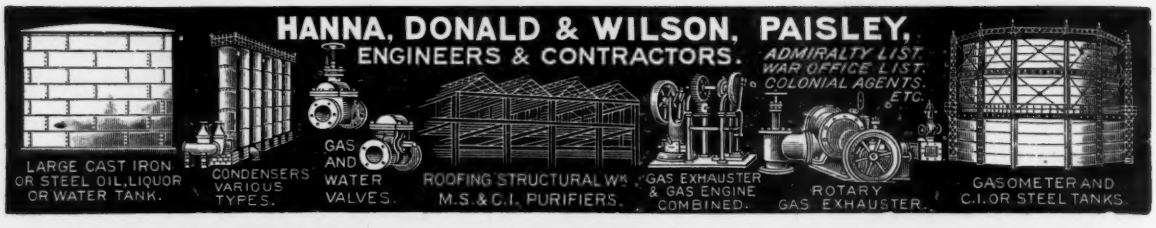
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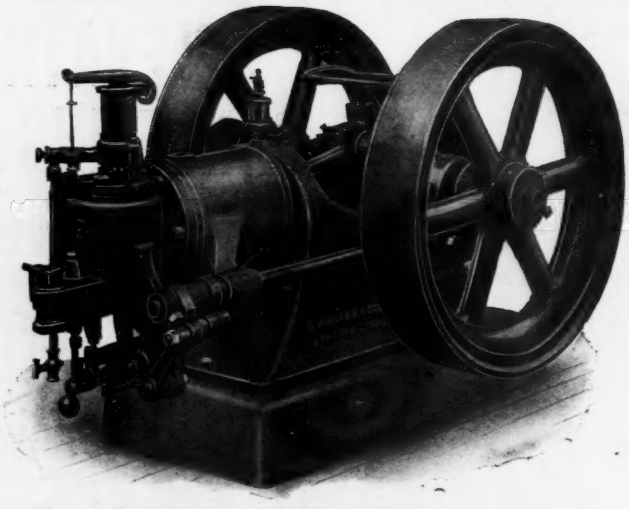

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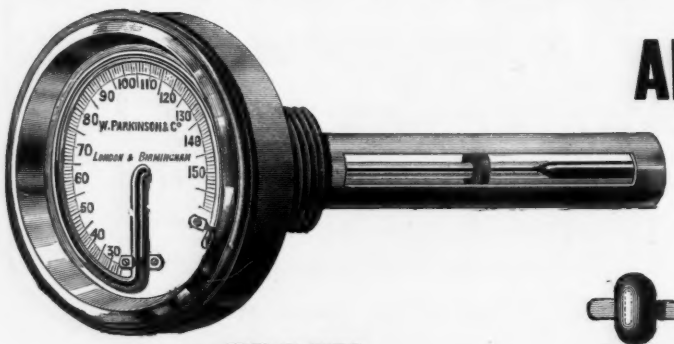

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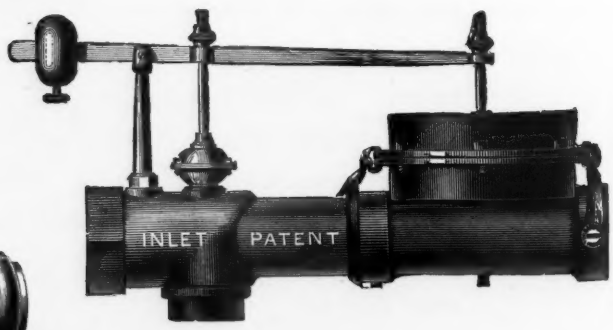

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CIX., No. 2439.—TUESDAY, FEBRUARY 8, 1910.

EDITORIAL NOTES—GAS, &c.

Economy and Municipal Discouragement. An Inquiry Proposed.

IF there were present at Friday's meeting of the Gaslight and Coke Company any of the stockholders of the now defunct West Ham Gas Company who had at one time any misgivings as to the wisdom of the amalgamation, from the West Ham proprietary point of view, with the Gaslight and Coke Company, those misgivings must have been completely dispelled by the accounts presented, and the explanatory and instructive statement made by the Governor (Mr. Corbet Woodall), who seemed to have nothing to do, so far as the finances and working were concerned, but to revel in good features, and to treat lightly (being anticipated) the only set-back in the matter of residuals. As our review of the accounts last week indicated, the Company's financial position has been strengthened in a remarkable manner; and this is due more to internal working than to external influences. There has been prudent capital administration during recent years; and the interesting story of the capital account told by the Governor shows the progressive lowering of new expenditure per million feet of gas, and, partly in consequence of this, a diminishing dividend charge per unit of sale. Yet we have never known the works of the Company to be in better case than at the present time. The very fact of accomplishment indicates the scope for this economy in connection with the Company. Then in relation to manufacture, since 1904 there has been an increase of no less than 10 per cent. in the production of gas per ton of coal carbonized, which represents a saving of 180,000 tons of coal a year—in other words, had the production per ton remained as in 1904, last year 180,000 tons more coal would have been required. Again, the fact of accomplishment indicates the scope for the economy in connection with the concern. On every side, there is the justification, and the proof of the necessity, for the release of the undertaking from the old absolutism in administration that crippled progress.

The enormous saving of 180,000 tons of coal a year is in itself a monument to the wisdom of the new policy. The saving, as the Governor says, is a matter not only for congratulation to the Company and consumers, but it is one of national importance. Any improvement that will increase the product and service of our natural and national heritage must be of importance to the country at large; and we know of no direction in which the economical use of coal is being fostered with such good effect as in the gas industry—not only through enhanced gas production, but through the encouragement offered to the use of gas and coke for heating, displacing, wherever change is made, the wasteful and barbarous modes of coal consumption. But the gratitude of the country to the gas industry does not find expression through either legislative or municipal channels; the main object—we regret there is occasion for saying it—appearing to be to trammel the industry as much as possible, either by enactment or by unfair competition. Improved working has also brought about economy in the manufacture of carburetted water gas, notably in the consumption of oil per 1000 cubic feet. These changes, which have so effectually altered the material fortunes of the concern, the Governor generously ascribes to the zealous labours of both the technical staff and the rank-and-file of the workers; and there is no doubt in his mind that the advances in the past year's working are partly due to the better relations established between employees and employers through the medium of co-partnership. Incidentally, it is recorded that the employee co-partners of the Company number 8700, and already there are 1500 of them on the list of proprietors. This augurs well for the future.

The increase of 4¾ per cent. in the consumption of gas in the past half year was regarded by the proprietors as satisfactory in itself, and as a sign of the return to a normal scale of increases. What are called "normal" increases are more difficult to obtain in these days than they were; the ruling conditions are to-day more favourable to wide fluctuations. Saturation level may have been practically reached by electricity; the worst of the declining consumption influence of the incandescent burner may have now been passed. But the fact remains that both causes have had effect in drawing closer the limits of the lighting business. The quantity of gas consumed for heating, cooking, and industrial purposes is on the increase. Use in these directions, however, is subject to uncontrollable circumstances. The degree of consumption for heating is under the dominion of the prevailing climatic conditions; and the industrial business is governed by trade prosperity and adversity. As the consumption of gas extends for these purposes, in many gas-supply territories "normal increase" will grow more and more a term applicable to a past day, and oscillations in consumption will become more and more pronounced. In the course of our comments last week, we asked, out of curiosity, in view of the great extension of the gas-stove connection in the Company's district, whether information could be given as to the proportion, approximately, of the day to the night consumption. For various reasons, at present, there is difficulty in quoting figures that would be instructive. The great activity in promoting connections of gas cooking stoves and fires is only a matter of some four or five years; and the period is really too short for comparative purposes. Moreover, the character and habits of the residents in the Metropolitan district cause considerable long-hour use of cookers and fires during the lighting hours; and this removes from the day hours much of the consumption that obtains in other than the lighting period in districts where the circumstances of life are of a different order. Again, the very magnitude of the Company's business produces big divergencies in the consumption from day to day according to atmospherical condition. Under the circumstances, it does not appear possible to give at present any reliable figures that would have particular instructive value as to the proportion of gas in the daytime contrasted with the lighting hours.

The Company have suffered considerably in the matter of the loss of public lamps at the hands of municipal owners of electricity supply undertakings; and the Governor made a vigorous and condemnatory attack on the preferential conditions that this ownership sets up to the detriment of the ratepayers, of which the Company is an exceptionally large one in many of the Metropolitan boroughs. He had an example upon which to work, the equal of which perhaps is not to be found in the length and breadth of the land—an example in which all commercial and economic considerations have been set at naught, an example in which every act on the part of the Borough Council (unnamed by the Governor, but known to be the Marylebone) has been an injustice to the Company as competitors of the municipally owned electricity undertaking. The Governor hit out freely, in dignified and unimpassioned language, at the municipal arbitrariness and the sole motive of electrical favour. The occasion demanded it. In no one respect can justification be shown by this particular Borough Council for what they have done; and what they have done will, unless some power steps in to prevent the miscarriage and abuse not only of justice but of local administration, be copied elsewhere. Indeed, though the most prominent case, Marylebone is not by any means the only instance in the country of this preferential treatment of the electricity undertaking at the expense of the ratepayers. It is, as Mr. Woodall says, in his concluding remarks, a matter that calls for searching investigation and prompt action; and we would emphasize, and earnestly urge

upon the notice of the administrators and executive officers of all Gas Companies, his concluding words.

> Neither the Local Government Board nor the Board of Trade appears to possess powers adequate to deal with the emergency which has arisen ; and I venture to suggest that one or the other or the Treasury should procure the appointment of a Commission, or a Committee of Inquiry, having the necessary competence.

The Gas Companies' Protection Association some time ago had this question under their consideration; and perhaps the Governor's remarks and suggestion will do something to accelerate movement in the matter. The situation imperatively demands prompt action. The tale and the protest as given in the report of the proceedings at the meeting of the Gaslight Company should be read by all who have at heart the interests of the gas industry, and by all who are the lovers and defenders of fair play.

More Glare.

THE February number of the "Illuminating Engineer" contains the text of the paper on "Glare," which was read by Dr. J. Herbert Parsons, F.R.C.S., on the 11th ult., together with a report of the discussion which followed the reading of the paper, and a number of communications on the subject from scientists and technical men abroad. Extracts from the paper and a summary of the discussion have already been given in the "JOURNAL" (*ante*, p. 167). A few of the communications from abroad—notably a pithy one from Professor H. Strache, of Vienna—treat the question of glare much as we suggested it should be treated in our editorial comments upon the paper and the discussion in the "JOURNAL" for the 18th ult. (p. 147). Nevertheless some of our words are quoted by our contemporary as meriting reproof, which it proceeds to administer in very ponderous phrases, through which however runs an undercurrent of excuse for the mistake which was made of devoting one whole meeting to the views of physiologists on the subject. Discussion of a question from one standpoint only is apt to vex the man of broader views; and we are glad to believe that the Illuminating Engineering Society will not repeat its initial blunder of inviting gas and electrical engineers to listen for an hour and a half to physiologists in debate one with the other. Had the communications from abroad been made available for publication in our columns along with the extracts from the paper itself, readers might have been saved from gaining the impression that the new Society was, despite its title, in reality a physiological debating society.

Provisional Orders—More Stand-by Clauses.

THE changes in gas legislation of recent sessions have made their mark on Gas Provisional Orders. There was a time when the drafts of the proposals submitted to the Board of Trade and the Local Government Board had the characteristics of being stereotyped and as dry-as-dust. There are for the coming session no less than thirteen applications to the Board of Trade, and one to the Local Government Board; and most of them are the promotions of moderate sized Limited Companies, desirous of expansion, and at the same time applying to their operations modern legislative developments. Particularly is it noticed that there is not a single instance in which anything more than a standard illuminating power of 14 candles is asked for, with the use in testing of the "Metropolitan" No. 2 burner. The Sheffield Company are seeking sanction, *viâ* the Board of Trade, for bringing themselves under present-day prescription in both respects. Throughout, where money powers are sought by the Orders, provision is made for the application of the revised auction clause as introduced in 1908, and which clause has not such an amount of irksome conditions about it as its immediate predecessor had. The model provision as to prepayment meter supply also consistently appears; and in several cases the special purposes fund clause is inserted. We may hazard the opinion that the two or three companies who have included the old renewals fund clause in their draft Orders will, before the session is through, find the special purposes fund clause substituted; the creation of the latter having been the outcome of the distaste of the parliamentary authorities for the renewals fund clause, and in its operation it is intended to displace both the old renewals and insurance funds clauses.

Last week, reference was made to the fact that three Bill promoting Gas Companies and two Local Authorities were seeking the protection of stand-by clauses—in the cases of the Local Authorities in respect of both private gas and electricity plants. In four of the Provisional Orders under review this week, like protection is sought, but equally in different manner. In two cases—the Orders of the Burnham and Highbridge Gas Companies—a no-penalty clause appears. In other words, it is proposed that the Companies shall not be liable to penalty for neglect or refusal to give a supply of gas where suction gas is used, if, and so long as, in their opinion, it would interfere with, or jeopardize, the supply of gas for public or private lighting, and to consumers not using private gas-producing plants. This is all right in its way; but it does not make provision, where the consumption is not of profitable quantity, for the compensation of the gas suppliers in the matter of expenses they incur in providing the stand-by. Such provision is made by clauses on the lines of the Heywood and Mountain Ash precedents of last year, as were cited in the "JOURNAL" for Nov. 23 last (p. 525). In the present group of Orders, the Mountain Ash precedent is found in those promoted by the Dinnington and District and the Sudbury (Suffolk) Gas Companies. There are, therefore, three forms of protective stand-by clause in the Bills and Orders for the coming session—the Heywood, the Mountain Ash, and the no-penalty clauses. If the clauses are successful, as were the Heywood and Mountain Ash ones of last year, we should imagine that no gas company or supplying local authority will in future approach Parliament without asking for the simple but useful permissive power.

Light and Inundation.

THOUGH the newspaper accounts have been copious, from them the real seriousness and terrible character of the inundations in Paris cannot be fully grasped a distance away, however well one may be acquainted with the affected areas. Now that the floods have subsided, though it will be some time yet before the mischief is completely repaired, and Paris assumes its normal aspect, the question is already being considered as to how such a disaster can be averted in future, and incidentally how the provision of artificial light can be assured. The electricity supply to the city failed at an early stage of the catastrophe, owing to the flooding of the power stations and the cable conduits; but it was only in comparatively small districts that the supply of gas was throttled by the water invading the distribution system where the pipes became broken. Unlike the electric power stations, too, certain of the gas-works were fortunately safely above the highest flood-level or outside the area affected by the inundation. Where there was deprivation of artificial light, there the difficulties and sufferings during the hours of darkness were greatest. The Minister of Public Works has already been considering how such deprivation can be averted for the future. Gas and electricity mains, drains, and so forth, are all huddled together underground; and M. Millerand, the Minister in question, says that an accident to one must affect the rest, and so they must be separated. The matter is not one to be dealt with by hasty project before there has been an opportunity of calmly surveying the position. To separate all the underground services of the kind would be an enormous and costly task. It would seem that what has to be legislated for and guarded against, in relation to floodings, are the causes rather than the effects. For instance, there would be little good transplanting the electrical conduits, while the power stations remain subject to flooding; and if provision can be made for preventing the floodings, the power stations would be safe, and still economically placed so far as transport and water supply are concerned. It was expected that one of the electric power stations—that at Rue Bergère—would be at work by Saturday last; and, in view of this, cables were being carried over and along houses as temporary means for giving a supply of current. But the big power station at Issy-les-Moulineaux has received such considerable damage, that it will take many weeks to straighten affairs out there. Workmen have also been busy on the broken gas-mains, and have promptly restored the supply in the small areas deprived of gas. Here, again, gas has scored. Not only was it less affected by the floods than the electric supply, but where it was so affected, it was more quickly re-established. At the time of writing, petroleum lamps are lighting such fine thoroughfares as the Champs Elysées and the Quai de l'Archevêché. Such illumination must look strange. But

Parisians have long since learned that the primitive candle and the oil-lamp, with or without inundations, are indispensable concomitants of electricity supply.

The Cost Controversy Continued.

THE erratic statements and flights of imagination in which electricians indulge when making comparisons between gas and electricity require no exemplification in these columns. In their own localities, most gas engineers have become intimate with them. But it is found that when—we may repeat the word "when"—electricians can be drawn from insinuation to categorical declaration, it is an easy matter to put them completely to rout. By no means would we impugn the seriousness with which electricians hold their beliefs regarding gas; but we do impugn the knowledge serving as the foundation of those beliefs. They fling their assertions about in the most reckless manner; and these assertions find as easy entry into the columns of "The Times" as did the famous Pigott letters. Allusion was made last week to the controversy that has been provoked by one of "The "Times" contributors through his partizan advocacy of electric lighting and his traducement of gas lighting. The controversy a week since had reached the point where the "Contributor" and Mr. H. H. Holmes, Sales Manager to the Marylebone Borough Council, essayed to undermine the denial by Mr. Hanbury Thomas of the original statements in our morning contemporary. Mr. Hanbury Thomas's maxim in controversy is "Facts not Fancies;" and he has now, in his retort, come down with such a sheaf of solid representatives of the former that "Contributor" will find some difficulty in beating a dignified retreat. This electrical advocate, as well as others, have attempted to minimize the renewal expense of metallic filament lamps by pointing to the renewal costs of gas mantles, which latter costs it has become an electrical habit to place at almost fabulous figures. All gas companies can just as easily dispose, by their own experiences, of the fictitious assertions as Mr. Hanbury Thomas does by the concrete experience of the Sheffield Gas Company, who maintain about 27,000 burners, with an average use of mantles during the twelve months of 3·16 per burner, many of which mantles are fixed in public houses and shops, and come in for somewhat rough treatment. This is only one out of several points treated upon in Mr. Hanbury Thomas's communication; but perhaps Mr. Holmes, with his unquenchable affection for his little stock of accounts that show a "saving"—whether illuminating power and duration of use are the same is a matter of pure conjecture—by the substitution of gas by electricity for lighting (probably after Mr. Holmes has made an estimate of the gas consumed for cooking), will find most interest in the quotation of substantial accounts by Mr. Hanbury Thomas that exhibit a saving by the conversion from electricity to gas. The figures (reproduced in our news columns) are only examples of what every gas undertaking in the country can produce where there is a competing electricity supply undertaking. A second letter, written by Mr. J. S. Owens (and also reproduced elsewhere) forms another contribution to the dispersal of the errors of our electrical competitors regarding carbon dioxide and other products of the combustion of gas. Independent testimony of this character is valuable.

National Memorial to the Late Sir George Livesey.

In our "Correspondence" columns to-day, there appears a letter from Mr. C. E. Jones, suggesting a national memorial to the late Sir George Livesey, and inviting discussion with the view to bringing the proposal to a successful issue. Our columns are freely open for such a purpose; but we do feel, in giving publicity to Mr. Jones's letter, that it is our duty to say that we fear the project can only end in failure. We quite agree that the work of Sir George—diversified and far-reaching in character as it was—is deserving of greater public recognition than it has yet received. The very fact of his knighthood points to work of public importance beyond the bounds of the gas industry, though the work in the industry itself—producing as it did cheaper gas for the country at large, and binding together to so great an extent the interests of gas consumers and the industry—was of such extraordinary public value as to merit proper recognition outside the industry. What should externally appeal with stronger force are his magnificent and successful labours in the social amelioration of the lot of industrial workers, and in producing a durable pacification between capital and labour. In short, Sir George did more good in his life than many men who have had public memorials set up to perpetuate their names. But what he did in this direction was done without ostentation; and the complete measure of it, or the extent of the ramifications of its effect, will never be fully known. So much of what we of the gas industry know—and it is great—of Sir George and his work, is not common knowledge outside; and we are afraid an external appeal for funds for the purpose suggested would not bear fruit, while in the industry itself it will be felt that the commemoratory object of the Leeds University Endowment Fund has been attained. In an attempt to create national interest in, and to collect funds for, the project, Mr. Jones should have issued his appeal through the public organs. There were, however, appeals made through them in connection with the Endowment Fund; but with what result? We know the difficulties of raising funds, and did our utmost in connection with the one just named; and with the experience so fresh in our memory, it may as well be frankly said at once that we cannot encourage hope of success for the idea put forward by our correspondent.

Gas Companies and the Northern Coal Trouble.

The trouble among the miners in Northumberland and Durham, through the Coal Mines Regulation (Eight Hours) Act, appears to have had a variety of effects in connection with gas-works supplies. The Governor of the Gaslight and Coke Company (Mr. Corbet Woodall) says they have had ample supplies of coal during the winter, and have now a large stock at the stations; and there is no cause for anxiety in this regard. While this is so, news has been received of boats for London gas-works being held up in the North. As to the settlement of the matters in dispute, Mr. Woodall is decidedly optimistic, notwithstanding the disquieting reports of the last week or so. He says that "the disputes at the collieries appear to be practically settled; and there is good reason to hope that full work will soon be resumed, and the supply abundant." On the other hand, the Chairman of the South Metropolitan Gas Company (Mr. Charles Carpenter) and his fellow-Directors still regard the position as one for some anxiety; and they have insured against an interruption of supplies of coal by laying down an increased stock. They hope, however, matters will have settled down before the time comes for making fresh contracts. One particularly large Gas Company have advanced the time for making their contracts by entering into new ones before the close of last year for coal required from the end of next June. At the Tottenham meeting on Saturday, it was also reported that the Directors had bought a substantial portion of their coal requirements from June forward, at the prices paid for the current contracts, and the supply of oil to July, 1911, at very much reduced figures. These engagements on the part of coal owners do not suggest that they are apprehensive of any disturbance that would justify them in asking for higher prices, and in delaying entering into contracts. Herein perhaps is one reason for the optimism felt and expressed by the Governor of the Gaslight Company.

Coalite Gas and Electricity Generation.

The British Coalite Company, Limited, have received another check in the matter of getting rid of their gas from the Barking plant. Their various unsuccessful plans for doing so were referred to in the "JOURNAL" for Jan. 11 (p. 85); and a new project was also mentioned. It was that the gas yielded in the carbonization of the coal for the production of coalite should be employed for the generation of electricity, and that the latter should be supplied in bulk to the Barking District Council for distribution by them through their electricity supply undertaking. Terms were submitted by the Company to the Council; but we now learn that the Electricity and Tramways Committee have decided that the offer cannot be accepted on the suggested terms. Once more the hopes of the Company are dashed to the ground, unless they are prepared to make the terms such that they are acceptable to the Barking Council. Acceptable terms to the Council may mean unprofitable ones to the Company; for electrical generating plant is not a particularly cheap line. Meanwhile, the Barking Council have received sanction to a further loan for their own electricity undertaking, which does not look as though they seriously contemplate having recourse to the aid of any outside source in providing the electricity required in their district.

A Question of Principle.

We are in this country accustomed to pride ourselves, and with most ample justice, upon the purity of our public life. It is, indeed, a comforting reflection to be able to make; but it would seem that in one town at least there are certain councillors who are unduly fearful lest any reproach should fall upon them as a body. At any rate, this is apparently the explanation of the attitude adopted by the mover and seconder of an amendment, at the last monthly meeting of the Wigan County Borough Council, with regard to the appointment of a professional Auditor of the Council's accounts. This was in opposition to the proposal of the Finance Committee to appoint a gentleman who happens to be the nephew of an Alderman and the stepson of a Councillor who have devoted their services to the borough. One can agree with the assertion of the mover of the amendment that the appointment of Auditor was so important that "it should be above suspicion and criticism as to impartiality," and at the same time maintain that in the present instance this may fairly be considered to be the case. In the discussion which followed, it was clearly shown that the appointment was made upon merits; and as was pointed out by one speaker, adopting the principle of which the amendment was the outcome, "would debar hundreds of young men who might happen to be related in some way with members of the Council from applying for any position connected with the Corporation." On a division, the amendment was defeated by about four to one. It nevertheless threatens to have a disastrous result which it is sincerely to be hoped may be obviated. That is to say, during the meeting the Alderman in question, who has given very many years to public work in the town, and is Chairman of the Finance Committee, declared that, so as not to jeopardize the future of the young man who had been chosen as Auditor, he would resign his position in the Council. If this decision should prove irrevocable, Wigan will have lost an honoured and steadfast worker through what (though the principle for which these members contended might be justifiable in the abstract) certainly seems an unnecessary display of anxiety that the Council should be "above suspicion."

The Difficulties in South Wales.

There seems to have been but little change for the better during the past week or two in the position of the South Wales coal difficulty. In fact, in some quarters the possibility of a stoppage at the end of March, as a result of the action of the miners in deciding to terminate the existing agreement, was regarded more seriously; and this consideration has had a somewhat unsettling influence on the market. In spite of several meetings between the representatives of owners and miners on the Conciliation Board, it is hard to see that any progress has been made towards overcoming the obstacles that exist to an agreement being arrived at. The two questions already dealt with in discussion between the parties—the rate of pay for working in abnormal places, and the fixing of the minimum wage rate generally—have proved thorny ones; and suggested modifications on the one side, have failed to meet the views of the other. There has been in the past so much talk of strikes in this field, which have ultimately been obviated by eleventh-hour agreements, that the general public might be pardoned if they had come to regard such threats without any very great amount of alarm; but, of course, markets are always more or less sensitive to possibilities, as well as to probabilities. An argument against strikes in any particular coalfield (which may be commended to the attention of the men) is adduced by a Newcastle paper, which remarks that the lessened dependence which now exists on any one area reduces the likelihood of successful pressure being brought to bear by a stoppage of work. It is pointed out that, when Wales was first feeling the difficulty of the Eight-Hours Act, there were diversions of steamers to Northern ports for a short time; while it is now seen that, with the restricted output of coal in Durham and Northumberland, there has been a transfer of the demand in some degree to Scotland and Yorkshire. In other words, the production of coal has been so developed over long years, that there is not only now a vast output, but it is drawn from a much wider area than it was; and the means of transit by land and sea have been increased, until the temporary shortage of coal in any one district is soon met by supplies from another field. This is all very well so far as it goes; but there is something more—for the miners should also bear in mind the readiness of other countries to take advantage of any opportunities which labour disputes here may put in their way, especially with regard to the requirements of our foreign customers. German and American agents, says the Cardiff correspondent of the "Financial Times," are known to be actively engaged in seeking business in markets that have hitherto almost exclusively drawn their supplies from South Wales; and it is not improbable that they will succeed in securing business, if the representatives of the masters and men prolong negotiations after the end of this month. Glancing over the disturbed condition of the coal industry generally in this country, one would find difficulty in saying, with any degree of confidence, in which of the fields the Eight-Hours Act has proved to be most unpopular.

Labour Exchanges.

Last Tuesday, the Labour Exchanges Act was brought into operation; and many have been the hopes inspired in the breasts of the supplicants for employment by the fact that their needs have at length been taken in hand by a Government Department. It is questionable whether the exchanges by themselves will do much to afford relief. Experience does not give encouragement. Certain Provincial Municipalities long since tried experiments in this way on a small scale; but with only a moderate success. Provision, too, was made by the Unemployed Workmen Act, 1905, for the establishment of labour exchanges; but the powers then granted were not put into operation to any large extent. A wider foundation has been given to the new scheme; and it is under the direct control of the Board of Trade. Still, there are doubts as to its efficiency for the purpose. Where it will fail, though it may bring unemployed and would-be employers together in the smaller industrial operations, it will not create work, and work is the essential to greater employment. We do not hear of employers being idle from any lack of hands. The great fundamental problem, therefore, is to raise the level of direct production in this country; and until that is done, there will always be an army of unemployed among us. The gas industry will find little use in the exchanges. The labour constantly clamouring at its gates for work is greater than the need; and it is an easy thing to place hands on men—artizan and labourers—when occasion requires. Though the industry employs to-day more labour than ever, there are seasons when particular work slackens; and it is one of the most distressing of a gas manager's duties when he has to send a man adrift through an insufficiency of suitable work. To such men the labour exchanges may be—we do not say will be—of use as a registry office. But will that very fact inure to the undermining of his self-reliance, and cause him to be less energetic in personally seeking that which he requires? The answer, of course, depends upon the man. There are, however, men who will, as every employer knows, grasp the slightest excuse for loafing.

"Transactions" of the American Gas Institute.

We have received the volume of proceedings of the American Gas Institute for the past year. It contains the papers submitted at the fourth annual meeting, held at Detroit (Mich.) on Oct. 20, 21, and 22, under the presidency of Mr. Charles F. Prichard, of Lynn (Mass.), with reports of the discussions thereon and of the general business; the reports of the various Special Committees; and the lecture by Dr. Edward P. Hyde, on "The Relation of Natural Science to the Development of Lighting." Most of the papers and reports have been noticed in the "JOURNAL"—the one on "Calorimetry" last week. The technical matter is preceded by the accounts, which are signed by Mr. Albert B. Beadle, the Secretary and Treasurer, and is followed by an appendix containing notices of deceased members, questions submitted to, and answered by, the Bureau of Information, an addition to Mr. A. E. Forstall's paper on "The Sliding-Scale," a collection of "Wrinkles," the constitution and bye-laws of the Institute, and lists of the officers, committees, and members. As usual, a portrait of the President for the year forms a frontispiece to the volume, the contents of which, occupying nearly 1000 pages, have been edited by the Publication Committee.

At a recent meeting of the Council of the Institution of Municipal Engineers, the Committee appointed to draw up regulations for District Committees presented their report; and the draft regulations accompanying it were unanimously approved and ordered to be circulated. One of the regulations is to the effect that the Honorary District Secretaries are to report immediately to the Institution "all cases of alleged hardship or unfair treatment inflicted upon municipal engineering officials in their respective districts, whether members of the Institution or not," and furnish as much information on the matter as they can obtain.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 382.)

AGAIN the Stock Exchange has had a business week, with a great many more dark lines than bright ones in its spectrum. There were several sombre influences dominant during the week—Græco-Turkish friction, French floods, American Markets, &c.—and not much that was cheering. The opening day was pretty fair, thanks to the better feeling with which the previous week had closed. Consols managed a little rise, and Rails were quite happy. Tuesday was not so sunny. Gilt-edged drooped, and Consols fell $\frac{3}{16}$; others were irregular, and the Foreign Market, where touched by Near-Eastern affairs, was weaker. Wednesday was not at all cheerful, and most of the leading departments were lower. Consols fell, Rails were dull, Foreign were anxious, and American flat. Thursday was very dull and inanimate. All the old disturbing factors were at work, and markets continued weak. Friday was much the same, though the last part of the day was not the worst of it. Consols touched the very low figure of 81⅛, and closed with a fall of $\frac{3}{16}$. Anxiety regarding coals oppressed Rails; but the Foreign Market was relieved. On Saturday came a change; and a fair step towards recovery was effected. Consols picked up $\frac{3}{16}$; and other things were brighter. In the Money Market, the supply was very abundant. Discount rates hardened in the middle of the week, but relaxed before the close. Business in the Gas Market was scarcely as plentiful as the previous week; but the tone was strong, and many quotations advanced. A batch of them were put up one apiece by a sort of rule-of-thumb without discrimination; and of them some at least were worthy of higher promotion. In Gaslight and Coke issues, there was nice steady business in the ordinary, which crept up another half-point, and changed hands at the close figures of 105½-106. In the secured issues, the maximum marked $88\frac{5}{8}$ and $89\frac{1}{2}$, the preference 104½ free and 105 (a rise of ½), and the debenture from 81¼ to 82½. South Metropolitan advanced ½, with business at from 121½ to 122½. In Commercials, the 4 per cent. made 110 and 111, and the 3½ per cent. 105½ and 106—a rise of 1. Among the Suburban and Provincial group, Alliance and Dublin was done at 87½, Brighton ordinary at 155½, South Suburban at 120½, Southampton at 110½ and $110\frac{3}{4}$, Wandsworth debenture at $74\frac{1}{2}$ and $74\frac{3}{4}$ (a rise of 1), Chester at 110, and Liverpool "B" at 167 and 168. Many issues were quoted higher without business being marked in them. In the Continental companies, Imperial was unchanged at from 175 to 176½, ditto debentures realized 95½, European fully-paid $24\frac{3}{8}$, and ditto part-paid $18\frac{5}{8}$. Among the undertakings of the remoter world, Buenos Ayres changed hands at from 14½ to $14\frac{5}{8}$, Melbourne 5 per cent. at $101\frac{3}{4}$, Monte Video at $12\frac{7}{8}$ and $13\frac{3}{16}$, Primitiva at $7\frac{1}{8}$ and $7\frac{1}{4}$, ditto preference at from 5¼ to $5\frac{1}{16}$ (a rise of ⅛), ditto debenture at $99\frac{3}{4}$, River Plate at 17 and $17\frac{1}{4}$, ditto debenture at $99\frac{7}{8}$ and $100\frac{1}{2}$ (a rise of 1), San Paulo at $14\frac{7}{8}$, and ditto debenture at 51.

ELECTRICITY SUPPLY MEMORANDA.

The Fixed-Price Proposal—Nursing Consumers to Maintain Contentment—Undue Influences—Cost and Sanitary Considerations—From Above—Electricians and Gas at Fires.

THE revivalists in the matter of the old fixed-price-per-lamp-per-annum idea, to which attention was turned in the "Memoranda" last week, have beaten anything that has been done before in the way of getting the right side of the Daily Press to take up an electrical subject, and give it circulation, as something that is actually new under the sun. The conductors of the Daily Press cannot be expected to know everything—though some of them may think they do; and so it is not surprising that occasionally (sometimes frequently in the case of the sensation mongers at one-halfpenny a time) they get "taken in," and are induced to applaud with warmth something that most men really conversant with the matter condemn as impracticable. Ordinary newspapers and financial papers have gone out of their ordinary course in the past week to bestow unmeasured praise on the genius that hit upon the plan of charging a fixed price per lamp, quite unconscious of the fact that the original genius and his works were decently buried by the gas industry many decades ago; and for the very reason that Mr. R. Borlaise Matthews has found in his journeyings in Switzerland. In "Electrical Industries," he writes: The contention is that since the metallic filament lamps are so expensive, people will not burn them longer than they need the light. "If managers are going to base any systems of charge on this weak foundation, they are likely to be doomed to disappointment, for it is 'agin human natur.' The writer has just returned from Switzerland where a flat-rate per lamp is the normal method of charging. During the past twelve months, an enormous number of tungsten lamps have been introduced; but notwithstanding their cost of about 3s. 4d. per 125-volt lamp, it is interesting to note that users have them burning almost day and night, as they had been previously accustomed to do in the case of their carbon lamps." That is the resurrection of the gas industry's experiences in pre-metering days. But apart from this particular aspect of the question of fixed prices, there is the point to be noted by the gas industry as to the increased ability developed by electricity competitors in getting daily-read papers to disseminate more or less truthful information respecting electricity and its capabilities.

There are a few excellent precepts to be found in an article in the "Electrical Times" by Mr. L. L. Robinson, the Borough Electrical Engineer of Hackney. The heading to the article is "The Selling of Electricity," which is a very praiseworthy ambition on the part of any electrical engineer in these times. With Mr. Robinson's precepts, we are in hearty agreement. Here are a couple of specimens: "The best way for a supply manager to attain his object is to make sure that the consumer attains *his*." "There is no advertisement so good as a thoroughly satisfied consumer." These sayings are not new, but that does not detract from their excellence. "Meteor" in another part of our contemporary comments on the article. And from what he says, there appears to be some difficulty about keeping an electricity consumer thoroughly contented, and of preventing him being proselytized by the gas suppliers' canvassers. The electricity consumer, our journalistic friend writes, "must be nursed from the day of his birth, or he will never develop his full appetite for electricity, to say nothing of the risk of his being kidnapped by the gas man." We cannot avoid acknowledging the open spirit in which this confession is made. Mr. Robinson's idea of the principal way of maintaining contented consumers, brings him into conflict with wiring contractors. The latter think they have rights and privileges that are sacred to themselves; in Mr. Robinson's opinion, the electricity supply authorities must usurp those rights and privileges, if such they are. The interests of the contractors and the supply authorities are antagonistic. The latter want the consumers to have cheap but not nasty installation; while the contractors (Mr. Robinson does not put it so bluntly as this) want as much money as possible spent on an installation, and to derive as much profit from it as competition will allow. In short, it is necessary for the lasting good of the consumer and the electricity supply undertaking that the central station engineer should have supreme control of the consumer's installation. Even then, as "Meteor" says, the electricity consumer "must be nursed from the day of his birth." And why?

Always amiably inclined towards the Gas Company, the Electricity Committee of the Hastings Corporation are ever on the prowl for fresh prey; and, truth to tell, they do not seem very particular as to how they get it. But an incident at a recent meeting of the Hastings Education Committee, over which the Mayor (Alderman R. W. Mitchell) presided, gives scope for fair complaint as to how a municipal electricity committee have, very unjustly, opportunity for vigorous wire-pulling to the detriment of its competitors, and at the cost of the ratepayers, of which useful element in a town the local gas company is not an unimportant unit. There is in local government an intercommunication, through the several committee memberships of individual councillors, that brings about an undue influence in favour of the electricity committee, where the electricity concern is owned by the municipal body. At Hastings, the Mayor is a strong champion of the electricity undertaking, and is *ex officio* a member of the Education Committee. Counting him, there are no less than six members of the Education Committee who are also members of the Electricity Committee. On the Education Committee's Sites and Buildings Sub-Committee (of which only three members are required to form a quorum), no less than five are members of the Electricity Committee. It really amounts to a scandal how, by such means as these, favour is obtained for the Electricity Committee, and fair and open competition is knocked on the head. With fair and square competition, the Hastings or any other Gas Company have no fear of not holding their own, as, for example, in the lighting by the Hastings Company of the St. Leonard's Pier. But when unfair influences are at work in the public governing body such as are found at Hastings, they must be galling in the extreme to the company against whom they are directed. Fortunately, the little scheme providing the incident giving rise to this protest against these undue and unfair influences, missed fire; but it was a narrow shave. It is palpable that, when the matter was before the Education Committee, there was a feeling permeating the proceedings that the project had a very defective base of justification. For the proposal, the Sites and Buildings Sub-Committee were responsible. They reported that the St. Mary-in-the-Castle Boys' and Girls' Schools are used by the Education Committee for evening classes; and it was thought it would be a great advantage to the students if arrangements could be made to substitute electric light for gas.

It was considered that 47 osram lamps of 32 hefner units would efficiently light the schools, displacing Welsbach "C" gas-burners. The cost of wiring, inclusive of the first lamps (not the renewals), was put down at approximately 15s. per point, or in all £35 5s.; but no mention was made of the cost of running the cable connecting up to the nearest distributing main. Nor was any estimate given of the annual cost, nearer than that a couple of units of electricity or thereabouts would be used per hour. Anything, however remote from the positive, was near enough for those interested in the Electricity Committee. The gas lighting of the schools cost £18 8s. 6d. for the year ending Sept. 30 last. The independent members of the Committee have but a poor notion as to the economic promises of the Electricity Committee. They have had substantial experience in street lighting by electricity. Councillor Cox asserts that the public buildings of the borough that have been lighted electrically are costing the ratepayers at least 30 per cent. more than when incandescent gas-burners were employed. Alderman Hutchings puts the cost at 50 per cent.

more. No one ventured into the open to say that the annual cost of lighting the schools would be below that of gas lighting. But some gems of knowledge were brought out in the course of the discussion. It was on sanitary grounds that some of the members voted for electricity. That sounds highly attractive. Certain of them had been to the schools in the evening time, after the rooms had been in use during the day, and after a number of students had congregated there in the evening, and with no discretion practised in the heating of the rooms. The ventilation of the rooms is admittedly bad. No wonder the members found the atmospheric conditions not altogether as they should be. Had the electric light been in use, they would have heard of stuffiness and headache. But if anyone wants to know anything about this matter let him apply to Councillor Stace, the Chairman of the Hastings Electricity Committee. His knowledge of the subject is remarkably profound; so much so that, we venture to think (assuming we have not been misled by a report in a local paper), a little time spent at an evening school where elementary science is taught would do him no harm. To him this piece of ungrammatically expressed nonsense is attributed by the local paper in question: "With regard to gas, there was seven times as much carbon thrown off than there was with a man breathing." It is unnecessary to go beyond this to show the depth of scientific knowledge upon which some local councillors found their arguments when attempting to build up a case. It is a pity there is not more care exercised, instead of allowing one's ignorance to make one look foolish in public. The letter by Mr. J. S. Owens appearing in our "Miscellaneous News" to-day, and an editorial article in the "JOURNAL" for Feb. 9 last year, p. 360, may be enlightening to Mr. Stace. We conclude from the report of the discussion that it is also a pity the Education Committee do not take the Gas Company into their confidence to a greater extent than they appear to do at the present time. The upshot of the discussion on the electric lighting of the schools was rejection of the proposal, but by only one vote. From what has been stated, we do not think that our complaint is at all unreasonable as to the composition of municipal Committees bringing about undue influence of a nature that is an obstacle to open and free trading in connection with local administration.

From time to time there is a revival of the proposal, in the quest for cheaper means of electricity distribution, of running overhead wires for the conveyance of electricity. The powers that be at Westminster will not countenance the idea; and, in respect of public thoroughfares and places, they are quite right. The occurrences on the 28th ult. in Dublin give support to the attitude of the authorities. There had been a heavy fall of snow; and the result was that telephone wires all over the city and in the suburbs were broken. There is a particularly heavy stretch of these wires in front of the Kingsbridge Station; and, at this spot, these fell and dropped across the tramway lines, which were carrying current at 500 volts, with the result that the telephone wires dangling into the thoroughfare were charged with electricity at this pressure. Three or four horses were electrocuted, a pony was instantly killed, a man leading the pony received such a nasty shock that he was thrown unconscious to the ground; while a youth, curious or careless, tried to lift the wires, and, in doing so, received a shock that rendered him unconscious, and burnt him so severely that he had to be removed to the hospital. Dublin has had, electrically provided, a fair amount of excitement lately. There have been failures of the electric current, and streets, shops, and private houses have been put into darkness; and now horses have been killed, people have received bad shocks, and the police have had their nerves put seriously to the test in trying to protect people from handling wires of the dangerous condition of which they were unconscious.

The severe fire shocks that our electrical friends have received lately have induced them to clutch at any paltry excuse for having a fling at gas. That sage publication, the "Electrical Times," excels among its contemporaries at this sort of thing. It was the publication that a short time since tried to involve gas lighting in the origin of the Clapham fire; it was also the publication that recently, after the Gaslight and Coke Company's workmen had, by the aid of pick and shovel, opened up the roadway near Blackfriars Bridge to discover a leak of gas that had contributed to an explosion in the Post Office telephone system and the neighbouring electric wire conduits, photographed the spoil, and published the picture as showing the effect of the explosion. A recent issue of our contemporary contains another example. There was a fire the other day at the premises of Messrs. Smith, Crotch, and Co., at Croydon; and the "Electrical Times," in its exuberant love for gas, says that the fire illustrates "the great increase in the difficulties which the fire brigade meets in the cases of fires in premises where gas is used." Assuming that gas has ever caused the fire brigade difficulties, it would be interesting to know what our well-wishers really mean by the difficulties having "greatly increased." We could have understood what was meant if they had said that, since the advent of electricity, the difficulties of the brigade have greatly increased, as the present Chief of the London Fire Brigade has on various occasions testified, and a number of big fires have demonstrated. According to the "Electrical Times," the gas-main to Messrs. Smith, Crotch, and Co.'s establishment contributed fountains of flames to the spectacle. That is quite a picturesque statement; but it may not be near the truth. It so happens that the firm named are the proprietors of the "Croydon Chronicle;" and in the account of the fire that they publish (no one ought to know the facts better than the tenants of the premises), there is not a single word about gas, nor is there in the official report issued by the Fire Brigade. No complaint is made by the latter of gas having in any way contributed to their difficulties. But the "Electrical Times" knows better than the Fire Brigade, and so complains for them. The "Croydon Chronicle" remarks that, filled as the premises were with "a great quantity of highly inflammable materials—oils, printing ink, paper, and the like—the flames spread with amazing rapidity; and in a few moments the basement and the ground floor were a raging furnace." And a little further in this same account, it is observed "there were loud explosions due to the fire catching the chemicals stored in the block-making department." The lighting and power supply of the building was electrical; and gas was used for the "Lino" machines and for a number of radiators employed for heating the premises. The official report of the Fire Brigade states that "the cause of the outbreak has not yet been ascertained." Perhaps it never will be now; and the occurrence will add one more to the long roll of those mysterious fires that have broken out in premises electrically lighted. The statements of the "Electrical Times" are instructive as to the state of the feelings at the present time of some of our electrical friends.

PERSONAL.

The Warrington Town Council have adopted a recommendation of the Water Committee that Mr. JAMES GRAY, the Assistant Water Engineer, be appointed Water Engineer, at a salary of £300 per annum.

At the monthly ballot for membership of the Institution of Civil Engineers last Tuesday, Mr. THOMAS GLOVER, Engineer and Manager of the Norwich station of the British Gas Company, and Past-President of the Institution of Gas Engineers, was elected a member.

At the meeting of the Paris Academy of Sciences on the 24th ult., Lord RAYLEIGH, the Chief Gas Examiner for the Metropolis, was elected a foreign associate member in succession to the late Professor Simon Newcomb. His Lordship was elected a correspondent of the Academy in 1890.

From among 138 applicants, the Colwyn Bay Urban District Council have appointed as Engineer and Manager of their gasworks Mr. JAMES SMITH, who at present occupies the position of Gas Manager at Congleton. Mr. Smith, who is 38 years of age, has been at Congleton for six years.

Mr. FRANCIS H. WOOD, the Manager of the Wokingham Corporation Gas Department, underwent a serious operation at the beginning of December in St. Bartholomew's Hospital; but his friends will be pleased to learn that he has now so far recovered as to be able to resume his duties at the works over which he has charge.

Mr. JOSEPH TYSOE, the Engineer of the East Greenwich works of the South Metropolitan Gas Company, has been granted by the Board three months' absence, and left England last Friday by the P. and O. steamer "Himalaya" for Cairo. Mr. Tysoe contracted an obstinate cough; and his medical adviser considered that complete change and a temporary holiday in a warm climate would be desirable to enable him to thoroughly shake off the troublesome symptoms. Mr. Tysoe's many friends will join in wishing him a pleasant time and a successful cure.

A few days ago, Mr. WALTER PARKER, an Assistant at the Carlisle Gas-Works, was the recipient of a suit-case, kit bag, and set of books, subscribed for by the staff and workmen, on the occasion of his leaving Carlisle to take up an appointment at the Bolton Gas-Works. Mr. T. Birkett, the Works Foreman, presided; and the presentation was made by Mr. Harold Bloor, the Engineer and Manager, who said that in the short time he had been acquainted with Mr. Parker he had formed a good opinion both of his abilities and character. He expressed the hope that Mr. Parker would be prosperous in his new position. Mr. J. Birkett, the Chief Clerk, spoke of the high esteem in which Mr. Parker was held by the office staff, who one and all hoped he would succeed in his profession. Mr. Parker, in acknowledging the gifts, said they would always remind him that he had good and true friends in Carlisle.

Obituary.

The "Journal für Gasbeleuchtung" reports the sudden death recently of Herr ERNST KUNATH, who was for many years Manager of the gas and water works at Dantzig, but from which position he had retired and gone to live in the neighbourhood of Berlin. Deceased had nearly completed his 68th year. He was one of the best known and respected of Continental gas managers.

Society of British Gas Industries.—We learn from the Secretary, Mr. Arthur L. Griffith, that the annual general meeting of the Society will take place at the Waldorf Hotel on Thursday, the 24th inst. At the commencement of the proceedings, the chair will be taken by the retiring President, Mr. Thomas Newbigging, M.Inst.C.E., after which the new President, Mr. J. H. Balfour Browne, K.C., will be inducted, and will deliver his Presidential Address.

THE CASE FOR THE STANDARD BURNER BILL.

[COMMUNICATED ARTICLE—CONTINUED FROM PAGE 289.]

THE second point on which opposition to the Bill may be based —viz., that, through the proposed change in the prescribed burner, the promoting Companies will be able to effect a reduction in the quality of the gas supplied, though the prescribed illuminating power remains unaltered—is dependent on the first point, and leads up to the third point, which is that the reduction (if any) thus effected, will have a more than proportionate deteriorating effect on the lighting duty of flat-flame burners. [The effect of a reduction in the illuminating power of gas on its value for heating purposes will be discussed more appropriately when the fourth point is dealt with.]

The second and third points inevitably raise the question whether the users of flat-flame burners still deserve any protection or consideration by Parliament, since flat-flame burners are now only retained in positions where the intensity of the light or illumination afforded is an extremely minor consideration. If through reduction in the quality of the gas a 14-candle-power flat-flame becomes reduced to 12-candle power, no consumer is really injured; for if the 12-candle flame is inadequate in power for his needs, he would be foolish to refrain from substituting for his flat-flame burner a small incandescent burner (inverted for choice), by which he would obtain double the light of his former 14-candle power flame, while his consumption of gas would be reduced to one-fourth. In the few positions where a flat-flame has some advantages over an incandescent mantle, it is perfectly immaterial whether the light is reduced by 1 or 2 candles. We no longer think of gains of 1 or 2 candles in the intensity of a gas-light as of any moment—the incandescent mantle has enlarged our views as to the scale by which increment and decrement of lighting power should be measured. *Now that 10 and 20 candles can be gained through a scarcely perceptible increase in the gas consumption, or by the adoption of an improved type of incandescent burner or mantle, it seems puerile to continue to discuss a loss of 1 or 2 candles in the light afforded by a flame.* Since, however, the *raison d'être* of statutory testings of the illuminating power of gas must now be almost solely the protection of that quaint survival of a bye-gone era—viz., the consumer who continues to use flat-flame burners—a few more words must be devoted to the question of the effect of a reduction in the illuminating power of gas on the light afforded by flat flames. As the Companies promoting the Standard Burner Bill are not asking for the abolition of statutory testings of illuminating power, but only for a change in the standard burner used in those testings, *it must be admitted that they are extending to the user of flat-flame burners far more consideration than his relative importance in the cosmos of gas consumers warrants.*

A flat-flame gas-burner of any but the most primitive type is designed to produce from gas consumed in it at a certain rate a flame of relatively high luminosity and free from smokiness. The maximum degree of luminosity from a flame is obtained, *cæteris paribus*, when it is on the verge of smoking—that is to say, the air supply to the flame must be restricted to as great a degree as is possible, compatible with the carbon in the flame being completely burnt. With flat-flames, the air supply is determined mainly by the velocity of issue of the jet of gas, although the form of the burner-head and the shape of the flame also affect the flow of air to the flame. If the jet of gas issues at a great velocity, it draws to the flame more air than is needed for the combustion of the gas. The strong indraught of air distorts and over-aerates the flame, with the result that the latter begins to approximate in character to the non-luminous bunsen flame. Hence the orifice (holes or slit) of the burner is made of such cross sectional area that gas will pass through it at the designed rate of consumption when the pressure at which the gas enters the orifice is comparatively low. If the pressure immediately anterior to the orifice is raised, more gas passes through the latter, and the velocity of efflux is increased.

The volume of air drawn to the flame increases with the velocity of efflux of the gas in a higher ratio than the volume of gas passed by the burner; and, consequently, if the air supply to the flame is correct at the lower rate of flow of the gas, it becomes too great at the higher rate of flow. The flame therefore falls off in illuminating duty at the high rate of passage of the gas—*i.e.*, the ratio of the candle power of the flame to the number of cubic feet of gas passed by the burner per hour, is reduced. That is to say, when a burner is taking more gas than it has been designed to consume, each cubic foot of gas consumed yields less light than it should. On the other hand, the efficiency is not appreciably diminished when the rate of consumption is reduced below the normal rate for the particular burner; but the flame becomes flabby, highly susceptible to draught, and inclined to smoke.

This explanation of the functioning of flat-flame burners has been introduced here in order to show how, by misuse of such burners, gas may be made to appear to afford a lower illuminating duty in a particular type of flat-flame burner than it ought to afford. Entirely fallacious and misleading conclusions and arguments in regard to the effect of a reduction in the illuminating power of gas on its lighting duty in flat-flame burners have been based on results obtained through such misuse of the burners. Since conclusions and arguments of this nature are being used in an attempt to justify opposition to the present Bill, it is important that they should be refuted at once. The Gas Examiner for the Borough of Reading (Dr. Ashby) reported that it had been clearly shown by Mr. Dibdin that, "when gas of lower illuminating power is burned in a flat-flame burner, a greater quantity of it has to be used in order to obtain the illumination given by a richer gas than corresponds to the reduction of the lighting quality of the gas. That is to say, if the illuminating power of a gas is reduced by one-eighth, an extra quantity (considerably more than one-eighth of the poorer gas) must be consumed to obtain the same amount of light as was given by the higher quality gas. In other words, the illuminating value of the poorer gas is much less than its illuminating power."*

The foregoing paraphrase by Dr. Ashby of Mr. Dibdin's conclusions does not one whit exaggerate them, as expressed in a paper which Mr. Dibdin read in 1900 before the London Section of the Society of Chemical Industry ["JOURNAL," Vol. LXXVI., pp. 1395, 1452]. But these conclusions are based on the results of testings of which a large proportion involved gross misuse of the burners employed. For instance, Bray's fishtail No. 4 burner according to Mr. Dibdin's tests, consuming 4·3 cubic feet of gas of 16·2-candle power per hour, yields a light of 8·6 candles. On the other hand, the same light may be obtained with the same burner by forcing through it 9 cubic feet per hour of gas of 14·2-candle power. Hence Mr. Dibdin argues that if gas costs 2s. 6d. per 1000 cubic feet, the expenditure on 14·2-candle power gas must be 4s. 6d. in order to obtain from it the same light as is obtained for 2s. 6d. from 16·2-candle power gas.

This is, of course, an outrageous proposition which can only be substantiated by forcing through a burner which is designed to consume about 4 cubic feet of gas per hour, as much as 9 cubic feet per hour. The high velocity of the jet of gas, issuing at the rate of 9 cubic feet per hour through orifices designed to pass only about 4 cubic feet, draws in too much air to the flame, which becomes distorted and over-aerated, and the lighting value of the gas is in large measure wasted. If a flame of 8·6-candle power is desired from 14·2-candle power gas, a No. 4 Bray fishtail burner should not be used, but a larger size of the same type, or a burner of some other type better adapted for the consumption of gas of 14·2-candle power. If the No. 5 Bray fishtail were used with the latter, a light of 8·2-candle power could be obtained with a trifling, if any, increase in the rate of consumption of the gas. The development of the full lighting duty from gas depends on the use of a suitable burner for the quality of the gas, and on that burner being used at about the rate of consumption for which it is designed. Mr. Dibdin selected burners well adapted for the consumption of gas of about 16-candle power, and ascertained, by trial, the rate of consumption of each of these burners when it was affording "a fair and even-burning flame" with gas of that quality. He then tried the same burners with gas of lower quality; forcing them to burn at a much higher rate of consumption, and entirely ignoring the condition on which the tests with the richer gas had been based—viz., that the burners should afford "a fair and even-burning flame." The only thing indubitably proved in Mr. Dibdin's paper on the "Effect of Quality on Consumption" is the inequitable and reprehensible character of the method of research employed.

It is, however, possible to extract, even from the results recorded in that paper, some figures which indicate the sort of relation that really subsists between the light afforded by gas of high and gas of low illuminating power when the gas is burnt in flat-flame burners at about the normal rate of consumption for the particular burner—*i.e.*, so as to yield a "fair and even-burning flame." For instance, with 16·2-candle gas, Mr. Dibdin obtained a light of 11·8 candles from a consumption of 5·05 cubic feet per hour in a No. 5 Bray's fishtail burner, and with 14·2-candle gas he obtained a light of 14 candles with a consumption of 6 cubic feet per hour in a No. 7 Bray's fishtail burner. The illuminating duty is practically the same—viz., 11·6 or 11·7 candles per 5 cubic feet of gas consumed—though the gas in one case is of 16·2-candle power and in the other of 14·2-candle power. That is to say, a falling-off of 2 candles in the nominal or standard illuminating power of the gas in this case has involved no falling-off in the yield of light obtainable from the gas in burners of precisely similar type, provided the size of the burner is varied according to the quality of the gas.

Even if the same sized burner is used, no great advantage is proved for the high candle power gas by Mr. Dibdin's figures, wherever the normal rate of consumption for the particular burner is not exceeded. Thus, with the No. 7 Bray's fishtail, he obtained an illuminating duty of 11·7 candles per 5 cubic feet of 14·2-candle power gas, and of 13·7 candles per 5 cubic feet of 16·2-candle power gas. Here there is the same difference of 2 candles in the duty obtainable from the flat-flame burner as in the illuminating power of the gases used. If we pass to a burner which is better able to develop a good duty from gases of varying illuminating powers—viz., a Bray's union with Codac economizer —Mr. Dibdin records that a light of 14·6 candles may be obtained with it by the consumption of either 4·95 cubic feet of 16·2-candle power gas, or 5·4 cubic feet of 14·2-candle power gas. The duty here is 14·7 candles per 5 cubic feet for the higher and 13·5 candles for the lower quality gas, or a difference of only 1·2 candles

* See "JOURNAL," Vol. CVIII., p. 688.

in the flat-flame burner corresponds with a difference of 2 candles in the standard "London" argand No. 1 burner. The latter burner was the standard used by Mr. Dibdin for assessing the quality of the gas employed in his testings, and is also the standard burner prescribed in the Private Acts or Orders of many of the Companies promoting the present Bill. The last quoted figures, and certain other figures given by Mr. Dibdin, show that *when a flat-flame burner is used at about its proper rate of consumption, its light is less affected by a change in the quality of the gas than is the light of the "London" argand No. 1 burner.*

It follows from this proposition that the "London" argand No. 1 burner is unsuitable as a standard burner, because it exaggerates the differences between the lighting values of various samples of gas. If the standard burner makes one sample of gas appear as of 2 candles higher illuminating power than another sample, while there is a difference of only (say) 1 candle in the light afforded by the two samples in flat-flame burners of similar type, it is obvious that the standard burner does not properly reflect the relative values of the two gases to consumers who use flat-flames. The "London" argand burner No. 1 and, broadly speaking, all other argand burners which have been dignified as standards prior to the year 1905, fail in this respect. It has been shown that this is the case so far as the "London" argand No. 1 is concerned by results quoted from Mr. Dibdin; but the author now proposes to give some results of independent testings which lead to the same conclusion.

The unsatisfactory character of the most widely adopted standard burner of the past having thus been demonstrated, he will next give the results of testings of the relative illuminating value obtainable in a good flat-flame burner at a normal rate of consumption from gases of varying illuminating power, when the illuminating power is determined by means of the "Metropolitan" argand burner No. 2. These results will demonstrate that the latter burner gives to gas tested by it a value for the illuminating power which runs almost exactly parallel to the illuminating value obtainable from the gas in flat-flame burners. That is to say, there is a practically constant difference between the illuminating power of the gas as tested by the "Metropolitan" argand No. 2 and the illuminating value of the gas in a flat-flame burner over a wide range of quality of the gas. *No earlier standard gas-burner gave results similarly corresponding with the light obtainable by the consumer who uses flat-flame burners.*

(*To be continued.*)

MONUMENT TO SIR GEORGE AND LADY LIVESEY

In Nunhead Cemetery.

THE number of the "Co-Partnership Journal" of the South Metropolitan Gas Company for the current month has for a frontispiece a well-executed reproduction of the monument which has been placed over the grave of Sir George and Lady Livesey in Nunhead Cemetery. It is an obelisk of Aberdeen granite, bearing simple inscriptions recording the dates of the birth and death of those in whose memory it has been erected, and two Scripture texts (Ps. xxvii. 1 and the first part of Mal. iii. 17.) Referring to the simplicity of the inscription, the Editor, in the opening article, entitled "The Resting Place," which contains a small picture showing the position of the monument in the Cemetery, says: "There is no mention of the eminent engineer, the philanthropist, the industrial reformer, the man to whom the whole nation is indebted for so many unselfish efforts to remove evils and adjust burdens. How much might have been said! And yet we feel that the Executors have rightly understood the spirit and wishes of those at rest. . . . In years to come, when the principles of co-partnership are universally applied, it may happen that the names of the pioneers will be almost forgotten, and that only a few will know anything of the great work of George Livesey. It matters not. The triumph of the work we can imagine him caring about; but we cannot imagine him feeling very deeply as to his own part in it being recognized. . . . His memory will long remain with those who came into contact with him or have benefited by his influence, teaching, or administration. The spot where his body is resting, with that of the gentle, invalid wife who helped and inspired him, will long be visited by those who cherish the recollection of a man who was great because he was good, and fearless because he knew the secret of true strength."

Analysis of the Accounts of Water Undertakings.—In another part of the "JOURNAL" will be found the announcement that the "Analyses of the Accounts of some of the Principal Water Undertakings of the United Kingdom" for the year 1908-9, compiled by Messrs. Wood, Drew, and Co., Chartered Accountants, is now ready. This is the twenty-ninth year of publication; and the nature of the work is well known to those of our readers who are connected with the management of water-works. It is to them what "Field" is to their gas colleagues. The accounts dealt with are those of the Metropolitan Water Board for the two years ending March 31, 1908 and 1909, and of 24 Provincial water undertakings for the latter year. The "Analysis" is presented in the same form as its immediate predecessor, with the addition of particulars relating to the Middle Ward District of the County of Lanark.

PROVISIONAL ORDERS FOR 1910.

THERE are thirteen Provisional Order entries relating to gas for consideration by the Board of Trade, while the Local Government Board will only be called upon to consider a single Gas Order. Under the Private Legislation Procedure (Scotland) Act, 1899, there are four Orders dealing wholly with gas supply, and one incidentally. It may be remarked that in all the Orders where additional capital is sought, the new auction clauses are to apply. These will be found in the "JOURNAL" for Sept. 22, 1908, p. 773.

Dealing with the applications to the Board of Trade, the Brownhills and District Gas Order is the first to come under notice. It is introduced by the Ogley Hay and Brownhills Gas Company, Limited; and they are proposing that their limits of supply shall be Walsall Wood, Norton-under-Cannock, Ogley Hay, and Shire Oak—all within and comprising the urban district of Brownhills—and the parish of Ogley Hay rural. But a proviso is to the effect that the supply of gas to Shire Oak shall be subject to such terms and conditions as may be mutually agreed between the undertakers and the Lichfield Gas Company, and further that the promoters shall not under the Order supply gas to the part of the parish of Norton-under-Cannock at present supplied by the Cannock Gas Company. The share capital, it is contemplated, shall not exceed £30,000, consisting of the original ordinary and preference share capital of £12,000, and of £18,000 additional share capital. The dividend on the original ordinary capital is to be limited to 10 per cent., to 5 per cent. on the original preference capital, 7 per cent. on the additional ordinary capital, and 5 per cent. on the additional preference capital. The proposal as to borrowing powers is limited to one-third of the issued capital. Most of the powers sought are of quite common character. The standard illuminating power of the gas is to be 14 candles, tested by the "Metropolitan" No. 2 burner. The maximum price proposed for the gas is 4s. 9d. per 1000 cubic feet. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

The Builth Gas and Coke Company, Limited, submit a draft Order in which they define the limits of supply as the urban district of Builth Wells, the parishes of Llanddewir Cwm and Rhosferig, in the county of Brecknock, and the parish of Llanllwedd, in the county of Radnor. The contemplated capital is not to exceed £7500, whereof £2535 will represent original capital, and £4965 additional capital. The dividends proposed are 10 per cent. on the original ordinary capital, 7 per cent. on the additional ordinary capital, and 5 per cent. on the preference capital. To place the undertaking on the ordinary lines, it is proposed that the amount of money borrowed shall not be increased until it is less than one-third of the capital; and thereafter it is not at any time to exceed in the whole one-third of the amount of capital actually raised. A scarce provision in these days since the special purposes fund clause was framed, is the renewal fund clause. It reappears here, and proposes that such a fund shall be built up by appropriations from revenue equal to 1 per cent. on the paid-up capital. Land powers are also sought. The maximum price of gas is proposed at 5s. 6d. per 1000 cubic feet of a prescribed 14-candle power, as tested by the "Metropolitan" No. 2 burner. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Burnham (Somerset) Gas Order defines the area of supply of the Limited Company as the parish and urban district of Burnham, and parts (as specified) of the parishes of Berrow, Brent Knoll, and Burnham Without. It is proposed that the capital shall not exceed £16,825, consisting of the ordinary share "A" capital already raised of £6025, £4300 of "B" capital, and £6500 of additional capital. It is intended that the shares in the "B" capital shall be issued to the holders of shares in the "A" capital rateably according to their respective holdings. The dividends proposed are 10 per cent. on the "A" capital, and 7 per cent. on the additional and "B" capital. Borrowing powers on the one-third scale are desired. Special purposes and reserve funds are contemplated by the provisions. Land and works authorization is included. The standard proposed for illuminating power is 14 candles, tested by the "Metropolitan" No. 2 burner. A standard price of 3s. 9d. is named, with the sliding-scale operating on the ordinary terms. The prepayment meter clause appears among a number of other ordinary ones. A protective clause referring to suction gas is proposed in these terms:

> No penalty shall be incurred by the undertakers for neglect or refusal to give a supply of gas in accordance with the provisions of this Order to any company, body, or person who uses, or is in the habit of using, machinery or apparatus for making and utilizing suction gas, if, and so long as, in the opinion of the undertakers, the giving of a supply by them to such company, body, or person, would interfere with, or jeopardize, the supply of gas by the undertakers for public and private lighting, and to consumers not using such machinery or apparatus as aforesaid.

[*Parliamentary Agents: Messrs. Crowders, Vizard, Oldham, and Co.*]

The next Order is principally for the purpose of empowering the Chertsey Gas Consumers' Company, Limited, to raise additional capital. It is intended that there shall be an extension of the share capital powers to an amount not exceeding in the whole £30,000. On the new ordinary capital, the dividend is not to exceed 7 per cent., and on new preference capital 5 per cent. One-third borrowing powers and special purpose fund clauses are

found among others of ordinary type. The Company seek to adopt the "Metropolitan" No. 2 burner in the testing of their gas. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Cranleigh Gas and Coke Company desire authorization in respect of the construction and maintenance of further works and of the raising of additional capital. The latter it is proposed shall not exceed £12,000, provided that the share capital does not extend beyond £20,000. On such part as is raised as ordinary capital, the authorized dividend is to be 7 per cent., and on the preference capital 5 per cent. Confirmation is asked to the borrowing of £4000; and subject thereto, borrowing is not to exceed one-third of the issued capital. The purchase is provided for of lands on which to erect additional works. It is desired to apply the "Metropolitan" No. 2 burner to the testing of gas. The Company ask for a maximum price of 6s. 6d. In the prepayment clause, the terms are the usual; except that there is a variation in the maximum charge for the hire of a prepayment meter without fittings, which it is suggested shall be 8d. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Dinnington and District Gas Company, Limited, are forward with proposals for powers in respect of the supply of Dinnington and a number of neighbouring parishes in the West Riding of the County of York. The share capital, it is suggested, shall not exceed £48,000, comprising the ordinary share capital already raised of £12,000, and of additional share capital not exceeding £36,000. The dividend limit proposed on the original ordinary capital is 10 per cent., 7 per cent. on the additional ordinary capital, and 6 per cent. on the preference capital. Borrowing powers are limited to the usual one-third. Land and works powers are sought. It is proposed that the standard price shall be 4s. per 1000 cubic feet, with the sliding-scale operating on the ordinary lines. Special purposes fund, reserve fund, and prepayment clauses appear among others. It is suggested that "the price to be charged by the undertakers for gas supplied for public lighting within the limits of supply shall be such a price as may be determined, in accordance with the provisions of the Gas-Works Clauses Act, 1871, not exceeding 3s. 6d. per 1000 cubic feet." It is proposed that the standard illuminating power shall be 14 candles, tested by the "Metropolitan" No. 2 burner. The Mountain Ash stand-by clause (as published in the "JOURNAL" for Nov. 23 last, p. 525), for application to cases where a consumer has a separate supply, is inserted. [*Parliamentary Agents: Messrs. Torr and Co.*]

The Highbridge Gas Company, Limited, are seeking authorization in various respects. The area of supply is specified as the north and south parishes and urban district of Highbridge and a defined part of the parishes of Burnham Without and Huntspill in the county of Somerset. It is proposed that the share capital of the concern shall not exceed £13,500, constituted of the share capital ("A") already raised, of £3500; ordinary share capital ("B") of £2500, to be issued to the holders of the "A" shares rateably, according to their respective holdings; and additional capital not exceeding £7500. Maximum dividends of 10 per cent. on the "A" capital, and 7 per cent. on the additional and "B" capital are proposed. The formation of special purposes and reserve funds is provided for. The customary one-third borrowing power is requested. Provision is made for the necessary lands and works authorization. The prescribed illuminating power of the gas is placed at 14 candles, tested by the "Metropolitan" No. 2 burner. A standard price of 3s. 9d. is suggested, with the sliding-scale operating upon the usual terms. The prepayment meter clause is included; as is also a stand-by clause in the terms of that quoted in connection with the Burnham Order. [*Parliamentary Agents: Messrs. Crowders, Vizard, Oldham, and Co.*]

In the Order introduced by the Llanidloes Gas, Coal, and Coke Company, Limited, the limits of supply are defined as the borough of Llanidloes and the parish of Llanidloes Without, in the county of Montgomery. The share capital, it is suggested, shall not exceed £10,000, consisting of the share capital of £2500 already raised, and of additional capital not to exceed £7500, to be issued under modern conditions. The original capital is to be entitled to a maximum dividend of 10 per cent., the additional ordinary to 7 per cent., and preference shares to 6 per cent. Borrowing powers are proposed on the one-third scale. A renewal fund is contemplated, despite the existence of the special purposes fund set up partly in substitution by the parliamentary authorities. The promoters are taking lands and works powers. Gas of a standard illuminating power of 14 candles, as tested by the "Metropolitan" No. 2 burner, is proposed; with a maximum price of 5s. 5d. per 1000 cubic feet. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Ripley Water-Works and Gaslight and Coke Company, Limited, require certain authorization in respect of the gas supply to specified parts of the townships of Pentrich and Ripley in the county of Derby. In regard to Ripley, the limits are so much of the township and urban district as are not included in the area of the Riddings District Gas Company. The share capital, it is proposed, shall not exceed £19,000, consisting of £14,000 already raised and £5000 additional capital. The maximum dividends suggested are 10 per cent. on the original capital, 5 per cent. on the preference capital already issued, 7 per cent. on the additional ordinary capital, and 6 per cent. on the additional preference capital. Borrowing powers are proposed at the ordinary one-third rate. Special purposes and reserve funds, and land and works powers, are all provided for. The prescribed illuminating power is 14 candles, tested by the "Metropolitan" No. 2 burner. On a proposed standard price of 4s. 6d., the sliding-scale will operate on the usual terms. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Rowley Regis and Blackheath Gas Company are forward with an Order to empower them to supply gas in the township of Cakemore in the county of Worcester, to raise additional capital, and for other purposes. The proposal as to Cakemore is an extension of existing limits. In addition to the capital authorized by the Company's Act of 1886, the promoters ask for sanction to raise additional capital not exceeding in the whole £12,500, carrying a maximum dividend of 7 per cent. on the ordinary shares, and not exceeding 5 per cent. in respect of capital issued as preference. One-third borrowing powers on the original and additional capital are requested. Provision is made for the creation of a special purposes fund. Power is sought to enable the Oldbury District Council to give, and the promoting Company to take, a supply of gas in bulk at such point in the urban district of Oldbury or the parish of Cakemore as may be agreed. The prepayment meter clause in the usual terms is inserted. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Sheffield United Gas Company are up with a short Order to alter their prescribed standard of illuminating power to 14 candles, and to adopt the "Metropolitan" No. 2 burner in testing it. Consequent amendments are to be made in various of the Company's Acts and Order. It is proposed to modify enactment in respect to the holding of meetings in this wise: Section 52 of the Act of 1855 it is intended shall be read and have effect as if the words, "and the future ordinary meetings shall be held in the month of March in every year, or at such other time as shall be appointed for that purpose by an order of a general meeting," were inserted in that section in lieu of the words "and the future general meetings shall be held in the months of April and October in every year." One result of this change is that an amendment has also to be made in relation to the retirement-rotation and election of Directors. Provision is arranged for the declaration of interim dividends without calling a meeting of the proprietors. Sections in the Company's Order of 1893 referring to the issue of debenture stock are to be repealed; and new conditions are proposed. [*Parliamentary Agents: Messrs. Rees and Freres.*]

The Sudbury Gas and Coke Company, Limited, are applicants for additional powers. The limits of supply are to be the borough of Sudbury and the parishes of Great Cornard and Chilton, in Suffolk. Concerning capital, it is intended that it shall not exceed £24,616, consisting of £14,616 share capital already invested in the undertaking, and known as original capital, and additional capital not exceeding £10,000. The maximum dividend is placed at 7 per cent. The borrowing powers are not to exceed one-third of the issued capital. A renewal fund is contemplated. Land and works powers are sought; and it is proposed that the standard illuminating power be prescribed at 14 candles, tested by the "Metropolitan" No. 2 burner. The maximum price of gas is placed at 4s. 9d. per 1000 feet. The Mountain Ash stand-by clause appears. A purchase clause is inserted, excluding the Corporation from the right to purchase compulsorily the undertaking within ten years after the commencement of the Order; but subsequently, and within 25 years of the commencement of the Order, if the Corporation introduce a Bill, there is to be no opposition on the part of the Company, except in respect of the protection of interests. The lines of the terms on which an agreement or arbitration shall take place are included in the Order. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The last of the Board of Trade applications to be noticed is one from the Swansea Gas Company, by which they are seeking to extend their limits to such portion of the parish of Llansamlet as is not included in the undertakers' existing limits of supply, or within the authorized limits of supply of any statutory gas company, to a defined part of the parish of Clase rural, and to the parishes of Penderry and Cockett. [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

To the Local Government Board, the Warsop Urban District Council are applying for gas-supply powers; and the scheme comes into conflict with the plans of the Shirebrook Gas Company, as outlined in the Bill noticed on Jan. 25 (p. 226). The Council submit that they are, by the Public Health Act, 1875, empowered to supply gas within the part of their district not included in the limits of the Shirebrook Company; and they are, therefore, by this Order, applying for authority to establish and maintain a gas undertaking, and to supply gas. Subject to the consent of the Local Government Board, the Council have agreed to acquire, from the Mansfield Corporation, the rights, powers, and privileges in relation to the supply of gas exercisable by the Corporation in the district. Lands are scheduled for works purposes. The standard illuminating power of the gas is to be prescribed at 14 candles, tested by the "Metropolitan" No. 2 burner; and the maximum price for the gas is put at 5s. 6d. The price charged for gas for public lighting is not to be less than that charged to private consumers by more than 10 per cent. Authorization to borrow with the sanction of the Local Government Board is sought; and the moneys so borrowed are to be repaid within a period of fifty years as may be determined by the Board. [*Parliamentary Agents: Messrs. Torr and Co.*]

*** The Scotch Orders will be noticed next week.

The European Gas Company, Limited, have contributed £105 to the Mansion House fund for the relief of the sufferers from the Paris floods; and Sir John Aird, Bart., has given £100.

CENTRAL STATION GAS ENGINEERING.*

THE volume bearing the above title is called a Catechism; but, as its description indicates, it is in no sense a "shorter catechism." It may, however, be accepted as a confession of faith of the orthodox American gas engineer, and is well described by one of their journals as "the only comprehensive work on American gas engineering practice which deals with things as they are."

As its title page shows, it has been compiled from the answers sent out to the Practical Class of the Trustees Gas Educational Fund. This class, whose education is imparted by correspondence, has received mention from time to time in our pages, and is not entirely unknown to our readers. It will be worth while, however, before discussing the Catechism, to say a little about the inception of the class and the students who have profited from the information now made available for the general public.

The class owes its origin entirely to Mr. Walton Clark, who, in his Presidential Address in 1895 to the American Gaslight Association, said: "What effort is the Association making towards giving systematic aid to the mar7 boys and men, who, without the advantage of an advanced education, are struggling to fit themselves for positions of responsibility, while filling subordinate positions in our gas-works? The answer must be 'Nothing.'" Mr. Clark's recommendation for a Committee on Education was adopted, and he served as its Chairman until, in 1899, it was dissolved and the work continued on a broader basis under the Trustees of the Gas Educational Fund. Mr. Clark is Chairman of the Board of Trustees, five in number—three of whom are permanent, the fourth and fifth being *ex-officio* members as President and Junior Past-President of the American Gas Institute.

The cost of the work is about $4000 yearly, supported by voluntary subscriptions usually made on a five-year basis; the present series extending to 1913. Over $11,000 has been accumulated as a surplus fund. Approximately 1000 students have entered the class, and about 150 completed the three-year course. When it is considered that of the 1000 entrants, 260 belong to classes not yet graduated, and that anyone is allowed to enter without undergoing examination, it may fairly be said that the proportion of graduates is high. Each year the names of the graduating class are published in the "Proceedings" of the American Gas Institute.

From the beginning, the best engineering talent has been available for the conduct of this work; and though, since the formation of the Trustees, the responsibility for questions and answers has devolved upon the Secretary, he has always been able to obtain, *gratis*, criticism and advice, which, if valued at consulting engineers' prices, would have been very costly. Year by year, these answers have appeared in the "Proceedings" of the American Gaslight Association, and then of its successor, the American Gas Institute. Their value not only to the students, but to the gas profession at large, was early recognized, and the present book is issued in response to the demand that the information be placed in convenient form. So well was the course planned from the beginning, that few of the questions and answers needed to be omitted because of duplication; and while the entire field of the gas business has not yet been covered, the gaps are comparatively trivial. The book is divided into eight sections.

Section I.—General Definitions—treats of the classes and compositions of illuminating gases, and of the names of apparatus used in manufacture and distribution. It is very short, with only ten questions, occupying seven pages.

Section II.—Manufacturing Materials—is divided into three parts, treating of bituminous coal, anthracite coal, and gas oils respectively. The properties of a good gas coal, the location of the principal fields, the effect of size and of storage on carbonization results, the causes of spontaneous combustion, the comparison of various fuels for use in a water-gas generator, and the grades of gas oils in common use, are described in seventeen pages, with twelve questions.

Section III.—Manufacturing Plant: Construction and Operation—is the largest in the book, with 179 questions, answered in 346 pages. It is divided into three parts—viz., distinctively coal gas, distinctively carburetted water gas, and common to both coal and carburetted water gas. Under the first part come charging, drawing, and coke-conveying machinery, retort-benches, impurities, tar-extractors, exhausters, washers and scrubbers, and residuals. To retort-benches are devoted 33 questions with 76 pages, where, with many illustrations, are described the construction and operation of various types of benches. Thirteen pages are occupied with washers and scrubbers, and sixteen are devoted to residuals, where especial attention is devoted to ammonia. In the second part carburetted water-gas generating apparatus and manufacturing practice is fully described in 29 pages, representing the views of the largest manufacturers and users of such apparatus. Scrubbing, relief holders, oil-tanks and oil tar, complete the part. The third part deals in much detail with coal-handling machinery, boilers, engines and exhausters, condensers, purifiers, station meters, gasholders, street-main governors, measurement of pressures and photometry. It contains 162 pages, with many illustrations, and with problems designed to make the student do some valuable thinking.

Section IV.—Distribution System and Consumers' Appliances—tells, in 84 questions and 167 pages, of street-mains, services, consumers' meters, house-piping, burners and fittings, appliances and complaints.

Section V.—Chemical—comprises eight questions relating to acetylene, oxidation, combustion, atomic and molecular weights, and tests for carbon dioxide and sulphuretted hydrogen.

Section VI.—Physical—devotes 56 questions on 74 pages to many physical truths, a knowledge of which is necessary to the gas engineer. The calculation of weights from specific gravity, the variation of gauge pressure due to elevation, and the determination of maximum flame temperature of a gas of known composition are some of the problems set for solution. Two questions are devoted to showing how an absurd claim for the efficiency of any gas-making process can be disproved.

Section VII.—Masonry Construction—describes in 34 pages, brick, stone, concrete, lime, and cement, and their preparation for, and use in, building.

Section VIII.—Miscellaneous—is devoted entirely to a very detailed description of the treatment to be given persons overcome by gas. This occupies twelve pages, with thirteen illustrations, and is the most comprehensive and valuable presentment of this subject that has ever been printed. It was prepared by the largest Syndicate Gas Company in the States; and the employees of the Company are given regular drill in this treatment.

It appears from the above indication of the book's contents that Sections V., VI., and VII. would hardly find place (certainly not in their entirety) in the manual of a gas engineer, as the latter would go to proper text-books on these subjects for their fuller treatment. They are needed in the Catechism, however, to give the men and youths for whose benefit the class is conducted, the chemical, physical, and construction knowledge of most value in their work.

No pains have been spared to make the information readily accessible; for, in addition to the splendid topical arrangement, there is a good subject-index. Illustrations numbering 120 aid the clear wording of the text in conveying its lessons, and fittingly round out a volume which should form the beginning of the gas library of every "junior" in America.

* "Catechism of Central Station Gas Engineering in the United States." Published by the Trustees Gas Educational Fund, and compiled by A. E. Forstall, Secretary. New York, 1910. [Price, cloth, $5; flexible leather, $7.]

GAS-ENGINE THEORY AND DESIGN.*

As its name designates, this work is chiefly confined to the theory and design of the gas-engine; and for this reason it is more suitable for the student and those mainly interested in the mechanical details of the engine than for the practical user. The author is Instructor in Mechanical Engineering at the Michigan Agricultural College; and his remarks, as might be expected, are chiefly concerned with American practice.

After a brief *résumé* of the history of the gas-engine (with the making of whose history America, it may be remarked, had very little to do), the author passes on to describe a few of the principal applications of the gas-engine in the United States. The work is to a great extent spoilt by the entire absence of style, and the repeated examples of grammatical and constructive errors in composition. Here is an instance: "More work has been done on large gas-engines in Europe than here, since fuel economy is of greater importance there." And sentences such as the following frequently appear: "These gases and the ash weigh just as much as the coal and air consumed did," and "the car can be started and stopped quicker than an electric-car." Or is this to be regarded as an Americanism?

In his preface, the author states that it has been his aim "to make the treatment clear and concise; and for this reason every paragraph should be studied—not merely read over." This injunction is very necessary, for who, at the first reading, can grasp: "The ports are larger than is usual in such small engines; the gas-passages are as direct as possible; the exhaust port is uncovered while the piston travels the last five-eighths of its downstroke; the cylinder inlet port is uncovered a little later; the crank-case inlet port is uncovered the same length of time as the exhaust port"?

In a chapter on "Fuels," the author makes but the briefest mention of coal gas—the entire information on this subject throughout the book being compressed into a paragraph of six lines; and even this information is incorrect, for we are told that "the coal is placed in closed iron retorts, which are heated from the outside." Again, in describing carburetted water gas, the author states that "the gas is 'fixed,' the same as coal gas, by passing it through a superheater"!! This will be news indeed to readers of the "JOURNAL." Later, in a table giving particulars of the various fuel gases, it is stated that the heating value of "water gas" is 630 B.Th.U. per cubic foot. This is quite incorrect, for the figure should be nearer half of that quoted. It can hardly be intended for "carburetted water gas" as "oil water gas" immediately follows it, with a heating value given of 1000 B.Th.U. per cubic foot.

* "Gas-Engine Theory and Design." By A. C. Mehrtens. New York: John Wiley and Sons; 1909.

The author gives only very cursory attention to the subjects of "Governing," "Ignition," "Cooling," and "Exhaust," contained in four consecutive chapters. The best feature of the work are the chapters on the "Determination of the Principal Dimensions," "Forces Acting in the Gas-Engine," "Design and Dimensions of Parts," and the last on "Designs." These are well illustrated in an instructive manner; many of the drawings and diagrams being novel, and not to be found in any of the best-known books on the gas-engine. This part of the volume cannot fail to be of interest to those desirous of studying the theory and mechanical details of gas-engine design. But this said, there remain no opportunities for praise, though, on the contrary, many for criticism.

In short, we do not see the necessity for going beyond the work of our own writers on this important subject. At the same time, the works published, both British and Foreign, do not give nearly sufficient attention to the working of gas-engines on coal gas, or town gas as it is sometimes termed.

Comparatively few users of engines under 100 H.P.—and these are far in excess of those employing the higher power engines—are interested in suction or producer plants and all their attendant disadvantages. This being so, gas-engine literature should be rather of a nature to interest and assist the user of the 10 or 20 H.P. engine, as it is he who is chiefly in need of assistance, and he on whom the future prosperity of the gas-engine industry largely depends.

KRAMERS AND AARTS WATER-GAS PLANT.

Tests of a Unit at the Hunslet Works.

Some time ago, arrangements were made for the carrying out, by Professor W. A. Bone, Ph.D., F.R.S., &c., Chief of the Department of Fuel and Gas Engineering in the Leeds University, of a series of tests of a unit of the Kramers and Aarts water-gas plant, of a capacity of 500,000 cubic feet per day, erected at the works of Messrs. Clayton, Son, and Co., at Hunslet, Leeds. Professor Bone has submitted his report, and we give it herewith.

Duration of Trial Six Hours—10 A.M. *to* 4 P.M. *of Dec.* 1, 1909.

[All data referring to both volume and calorific value of the gas refer to "dry gas" at 0° C. and 760 mm.]

1.—Dry coke charged per hour = 5·91 cwt.

2.—Fuel charged was ordinary gas coke and contained 2·9 per cent. of moisture. The dry coke contained—

Carbon, 87·2 p. ct. Hydrogen, 1·2 p. ct. Ash, 7·3 p. ct.

3.—The calorific value of the dry coke = 13,300 B.Th.U. per pound.

4.—Average make of gas = 21,833 cubic feet per hour, at 0° C. and 760 mm.

5.—Mean percentage composition of two continuous samples:

Carbon dioxide	3·75
Carbon monoxide	43·70
Hydrogen	45·10
Methane	0·50
Nitrogen	6·95

6.—Mean calorific value of the gas at 0° C. and 760 mm.—

Gross, 308·9 B.Th.U. Net, 284 B.Th.U.

7.—Yield of dry gas per pound of carbon = 37·84 cubic feet at 0° C. and 760 mm.

8.—Percentage of carbon in coke appearing in the gas = 60·65 per cent.

9.—Ratios of the calorific values of the gas and coke—

Gross, 0·766. Net, 0·705.

10.—Clinker. Although the ash of the coke was ferruginous, the formation of large clinker was very small. The largest clinker formed during the trial weighed 10 lbs. only; and there were three others weighing 8, 7, and 6 lbs. respectively. All the rest were quite small, weighing less than 5 lbs. each. This was a most satisfactory feature of the trial.

11.—Unfortunately the weather was very cold and wet during the whole period of the trial; and although the plant was in a fairly sheltered position, the conditions were unfavourable. The plant worked very smoothly throughout the trial; the gas was of a uniform and good quality, and the make quite regular.

NEW INVERTED INCANDESCENT GAS-LAMP COMPANY.

Manufacturing Premises in Birmingham.

MANY of our readers are doubtless aware that the business of the above-named Company has hitherto been confined to the design and sale of gas burners and fittings, and that its growth necessitated some time ago considerable enlargement of their premises in Farringdon Avenue, E.C., in which their London offices and show-rooms are situated. In view of the success which has attended the Company, it has been deemed advisable to make arrangements for extending their operations. They have accordingly decided to become their own manufacturers; and with this object have acquired the works and business of the Sunlight and Safety Lamp Company, Limited, who have for some considerable time been the makers of their specialities. Consequently the Company are now in possession of a large and well-equipped factory—the Roscar Works—situated in a prominent position in the centre of Birmingham. It consists of a block of buildings, three storeys high, in Summer Hill Road. The various departments are furnished with plant of the most approved kind for the production of inverted burners and gas-fittings of all qualities. An interior of the premises is shown in the above illustration. The buildings are lighted throughout by means of incandescent gas-burners; and the power for driving the machinery is furnished by gas-engines. By this acquisition, the Company become possessors not only of a large well-equipped factory, but also of a technical and operative staff thoroughly skilled in the production of their specialities. They are therefore now fully prepared to cope with the increased business which the records of the past few years justify them in looking for in the near future.

THE STRIKE AT THE STOCKHOLM GAS-WORKS.

AUG. 6 TO SEPT. 5, 1909.

[COMMUNICATED.]

OF late years the Swedish labour market has been the scene of numerous conflicts of varying duration and import, which last summer led to a comprehensive struggle, extending throughout the entire kingdom, between the Employers' Associations and the Workmen's Unions, when about 280,000 men in all found themselves out of work owing to a proclamation made by the leaders of the workers concerning the great strike of Aug. 4. In this proclamation, however, it was expressly stated that the hands employed at the municipal works for the lighting up of towns, &c., were exceptions.

Furthermore, some years ago the town of Stockholm entered upon a collective agreement with all the workmen, in which the stipulation was inserted that on no account was work to be discontinued or abandoned; and by a special notice issued the attention of the workpeople was called to this stipulation. The Stockholm Gas-Works were, therefore, apparently protected from all danger in this respect; but the situation rendering caution necessary, those in authority chose—from among the employees of various grades who volunteered—a reserve band of workers, who, in case work was abandoned by others, would take their places. This reserve brigade consisted of 21 engineers and technicians; 21 counting-house clerks; 9 collectors; 20 meter-controllers; 16 workmasters and gasmasters; 19 foremen; and 19 watchmen and workers paid monthly.

The consumption of gas during the first few days of the strike was calculated not to exceed about 55,000 cubic metres per diem; and with the reserve brigade, it was deemed possible to produce about 45,000 cubic metres a day. Aided by the gasholders, which at this critical period were almost full—containing 120,000 cubic metres—the possibility was considered of being able to manage for the time it was supposed the strike might last—*i.e.*, a week or at most a fortnight. As a matter of fact, the strike was not over for a month. So as to keep the consumption within the limitations calculated, plans were made that, should necessity call for such steps, certain parts of the town should be cut off from delivery; and, if called for, the delivery pressure was also to be decreased.

The gas-works belonging to the town of Stockholm, the Värtan Gas-Works, are outside the town itself;* and here lodgings were put in complete readiness for the reception of the reserve brigade. A dining-hall was arranged; and a contract was entered into with a provision merchant, who undertook that two hours after due notice he would provide full board for the volunteers, so that the brigade could be entirely catered for at the works. The reserve brigade received mobilizing billets, containing a statement as to where the assembly order at stated times should be inquired for at a given telephone number; a list of the clothes which each person should take with him; and a statement of the kind of service, time of work, superior command, and quarters and time of meals, &c.

In order to ensure the uninterrupted continuation of the delivery, the due lighting of the lamps and their being extinguished, &c., a volunteer delivery brigade was also organized. It was formed by 3 engineers and technicians; 2 workmasters; 8 foremen; 35 clerks; and those gas-meter controllers and collectors who had not entered the gas-making contingent, together with some forty delivery workmen who were deemed reliable—most of them being lamplighters. For members of this brigade, printed directions were held in readiness; special maps being issued concerning the various districts which were to be lit.

Owing to the gravity of the situation, from the very first day of the strike the authorities placed the military at the more important points of the town; and at the request of the head of the gas-works, a troop of fifty men were stationed within the precincts of the works at Värtan, though completely shut off from the ordinary places where work was carried on, and not in sight of them.

In spite of the workmen being informed that the presence of the military was due to the desire to protect the valuable property belonging to the town from damage from outsiders, there were a certain number of agitators who succeeded in awakening an opinion against this precaution; the result being that an ultimatum was sent to the gas-works authorities that, unless the troops were withdrawn, work would be discontinued. Since the gas-works could not comply with this demand, after attempts had been made to prevent a strike, without any success attending the negotiations, work was discontinued on Aug. 6 at 6 a.m. The strike, it must be remembered, occurred against the wishes of the organized and more sensible hands.

At the Värtan works, there were 325 workmen; and of these, 275 went out on strike. Of the delivery workmen, numbering 327, there were 111 that struck work. All the lamp-lighters continued work; so that the volunteer delivery brigade was not called upon to light up.

The volunteer gas-making brigade, the members of which had received definite orders on the evening preceding the day on which work was abandoned, marched in when the men left the works. These volunteers, together with the workmen remaining

* In the town itself there are older gas-works, the Klara works; but these works are not used in summer, so were closed when the strike broke out.

Working Statement.

Date.	Gas Made. Coal Gas. Horizontal Retorts Worked by Hand.	Coal Gas. Inclined Retorts with Conveyors for Coal and Coke.	Water Gas.	Total.	Number of Workmen, (*a*) Old, (*b*) Voluntary,* (*c*) Newly Engaged, and (*d*) Total. Working of Retort-Furnaces. (*a*)	(*b*)	(*c*)	(*d*)	Working of Water-Gas Apparatus. (*a*)	(*b*)	(*c*)	(*d*)	Working of Steam Boilers, Exhausters, and Pumps. (*a*)	(*b*)	(*c*)	(*d*)	Coal-Conveyors (*a*)	(*b*)	(*c*)	(*d*)	Coke-Handling. (*a*)	(*b*)	(*c*)	(*d*)	Drudging and Repairs. (*a*)	(*b*)	(*c*)	(*d*)	Total. (*a*)	(*b*)	(*c*)	(*d*)	Per 1000 Cubic Metres of Gas Made. (*a*)	(*b*)	(*c*)	(*d*)
			Cubic Metres.	Cubic Metres.																																
July 31.	38,180	29,050	..	67,230	77	..	..	77	..	..	..	..	12	..	..	12†	14	..	..	14	33	..	..	33	189	..	..	189	325	..	..	325	4·83	..	..	4·83
Aug. 7.	2,040	35,920	13,880	51,840	181	36	..	54	..	5	..	5	4	17	..	21‡	1	8	..	9	6	4	..	10	21	46	..	67	50	116	..	166	3·20	2·70	..	3·20
,, 14.	1,480	45,570	13,360	60,410	18	36	1	55	..	5	4	17	..	21	2	12	..	14	6	12	24	32	..	56	54	108	1	163	1·98	2·70	0·43	2·73	18·3	2·73	0·43	3·31
,, 21.	..	60,780	..	60,780	20	33	1	54	..	3	5	13	..	18	4	10	..	14	9	6	..	15	23	34	5	62	61	99	6	166	1·98	2·73	18·3	3·31	0·43	2·97
,, 28.	..	59,250	4,820	64,070	22	26	2	50	..	4	5	19	4	10	..	14	4	10	..	14	10	6	..	16	22	50	37	109	63	110	39	212	3·31	2·97	18·3	3·02
Sept. 4.	..	67,470	11,390	78,860	26	27	6	59	..	6	1	7	1	16	4	10	..	14	5	13	26	31	38	43	112	74	96	64	234	2·97	18·3	3·02	11·1	3·13	18·3	3·13
,, 30.	29,400	80,820	..	110,220	89	..	4	93	..	..	..	..	1	5	11	..	10	18	..	27	5	13	..	18	169	260	..	73	333	3·02	11·1	3·13	11·1	3·13	11·1	3·13
Oct. 15.	40,900	71,150	..	112,050	97	..	5	102	..	..	..	..	1	12	12	..	..	7	19	48	29	..	..	29	170	48	..	48	351	3·13	11·1	3·13	11·1	3·13	11·1	3·13

* Exclusive of those who served by order. † Of these, 15 were stokers and coke quenchers. ‡ One boiler-room at work. § Two boiler-rooms at work.

REMARKS.

Gas made Aug. 6 to Sept. 5—
Coal gas . . . . . 1,689,670 cubic metres.
Water gas . . . . . 278,120 ,, ,,
Total . . . . . 1,967,790 cubic metres.

Contents of the gasholders—
On Aug. 5, at 11 p.m. . . . . 119,900 cubic metres.
On Sept. 5, ,, ,, ... 84,300 ,, ,,

Coal-gas works—
Output of gas per ton of coal . . . . . 299·9 cubic metres.
Water-gas works—
Output of gas per kilo. of coke in the generators . . . . . 1·98 cubic metres.
Oil per cubic metre of gas . . . . . 0·43 litres.
Illuminating power in Hefner candles (Carpenter burner at 15° C., 760 mm). 18·3
Calorific power (15° C., 760 mm.) . . . . . 4690 calories.
Total illuminating power in Hefner candles (Sugg's "London" argand burner No. 1, at 15° C., 760 mm.) 11·1
Total calorific power (15° C., 760 mm.) . . . . . 5160 calories.

at their posts, at once continued the gas-making, which during the entire month that the strike lasted was kept up to the amount necessary without any stoppage, dislocation of work, or damage to the material. Once or twice the gas-making had to be reduced, since more gas was being made than the gasholders could contain. When the strike began, not only the benches with horizontal retorts for hand-power, but also the benches with inclined retorts with conveyors for coal and coke, were working. In order to save labour during the first period of the strike, the alteration was made that the horizontal retorts were not used after the water-gas works had commenced working, and further firing was undertaken in the inclined retorts. The volunteer brigade (unaccustomed as the members were to physical labour) stood the test with due credit, and without any accident occurring.

The result of the work carried on under these exceptional conditions will best be judged from the accompanying statement.

When the leaders of the workmen subsequently declared the great strike to be at an end, they had imagined there would be a general return to work on the morning of Sept. 6. The gates of the gas-works were, however, closed against the strikers; they being obliged to apply for work at the head office in the ordinary way. Some of those who were engaged were given different work from that which they previously performed; their places having been filled by new-comers during the strike.

It is but natural that the Stockholm Gas-Works suffered great losses, both direct and indirect, in consequence of the strike. It may be counted as gain, however, that a much-needed elimination took place among the workmen. Moreover, there is the very valuable experience that large gas-works can be kept going with a volunteer staff, mostly recruited from among its own employees. This knowledge, together with the more stringent stipulations enforced on the workmen subsequent to the strike, should offer a guarantee that for some long period the Stockholm Gas-Works will enjoy immunity from strikes, and carry on work in peace.

THE CAUSES AND RANGES OF VARIATION IN CALORIMETRIC TESTS.

By Thomas Holgate, F.C.S., M.Inst.C.E.

When making tests of gas with the Boys calorimeter, a correction should be made for any difference in temperature between the air of the room and that of the gases leaving the instrument. This correction is included in the one stipulated in the Instructions issued by the Gas Referees as 1·6th of a Calorie for each degree centigrade. Mr. J. H. Coste refers to this,* and further names two sets of extreme conditions, and calculates what are the limits of error possible therein. In the first of the examples, he shows that the gross calorific value and the difference figure would both be appreciated 1·5 Calories per cubic foot of gas; while in the second he shows each would be depreciated 1·6 Calories.

If the Referees' correction be applied to these two examples, we have firstly (where air enters the instrument at 21° C. saturated with water vapour, and leaves at 10° C. saturated) $\frac{1}{6}$ Cal. × 11 = 1·8$\dot{3}$ Cal. or 0·$\dot{3}$ Calorie in excess of that computed to be required; secondly (where the air again enters at 21° C. and the gases leave at 25° C., with air at one-third saturation), the Referees' correction would be $\frac{1}{6}$ Cal. × 4 = 0·$\dot{6}$ against 1·6 computed, or a difference of 1 Calorie. These examples are here dissected to direct attention to the fact that the Referees' correction is one that includes temperature specifically, and other variables to an uncertain extent. In other words, there is no mention of its applicability to correct for variations of humidity or rate of flow of air in proportion to gas. The application of that rule in practice is confined to the gross calorific value of the gas tested. General considerations as well as Mr. Coste's examples show that the Referees' rule is an approximation only; and it is therefore necessary to further inquire what are the magnitudes of the several deviations mentioned and others that may occur under working conditions.

These disturbing factors may be classified as follows: (1) Changes of temperature at the calorimeter between ingoing and outgoing gases. (2) Changes of atmospheric relative humidity. (3) Changes of volume of air supply per cubic foot of gas burnt. The influence of these factors will be discussed in this order; but before doing so it will be necessary to state the data about to be employed. A sample of gas from the St. Helens vertical retorts, of 594 and 542·9 B.Th.U., gross and net, and having an illuminating power in the "Metropolitan" No. 2 burner of 3·372 candles per cubic foot, will be employed. It is given [*vide* "Journal" for June 8, 1909, p. 636], as of the following percentage composition:

Marsh gas	32·4
Hydrogen	49·7
Carbon monoxide	9·9
Unsaturated hydrocarbons	2·7
Carbon dioxide	2·1
Nitrogen	3·0
Total accounted for	99·8

It was pointed out by Dr. H. G. Colman, in the discussion of Mr. Coste's paper, that the analysis of a gas mixture is usually stated as though it were dry; whilst the actual gas burnt in the calorimetric test is moist, and that this shifting of the basis introduces an error in the comparison of the calorific values calculated and those observed. The remark is a just and timely one; but the error can only be obviated by the analyst giving in his return how much moisture the gas contained at the time of the experiment. As this may amount to 1·44 per cent. at 55° Fahr., 1·72 per cent. at 60° Fahr., or 2·05 per cent. at 65° Fahr., it is obviously erroneous to give figures which purport to be for a gas free from moisture, when the sample taken was in all probability measured moist, and might continue so throughout the series of absorptions. The substances removed by direct absorption—viz., CO_2, O_2, CO, and the unsaturated hydrocarbons, and nitrogen if determined directly or by difference—may be easily corrected by the usual simple rule; but marsh gas and hydrogen, which are usually determined by explosion, must be corrected after allowing for the air introduced, the subsequent shrinkage due to the condensation of water vapour, and the absorption of the CO_2 generated at the time of explosion. These attentions to detail are desirable for the accurate declaration of each of the simple combustibles, but emphatically so when it is wished to ascertain the calorific value to be assigned to the unsaturated hydrocarbons. In the absence of a statement of the carbon and hydrogen densities of the latter, no calculation of the calorific values that is reliable can be made; and then a computation by difference is all that can be attempted. Under these circumstances, all the errors due to incompleteness of the analysis are accumulated in the figures assigned to the C_nH_m, and may be a large proportion thereof.

Where the analysis is made by measurements at constant pressure over water, the following shrinkages take place as a consequence of explosion: (1) Marsh gas, 2 vols. + oxygen 4 vols. = CO_2, 2 vols. + water vapour 4 vols. That is, for each volume of marsh gas there is a shrinkage of two volumes of H_2O, and after the application of alkali a further one volume, or three volumes in all. (2) Hydrogen (4 vols.) + oxygen (2 vols.) = water vapour (4 vols.). That is each volume of hydrogen is accompanied by 1½ vols. shrinkage after cooling alone. The reduced volumes read off the burette will be due to the removal of the dry gases in direct proportion, and to the removal of water vapour in proportion to the shrinkages stated. But as the marsh gas is predicated from the CO_2 shrinkage, which is of equal volume, that component will suffer no increased error, but it will contribute twice its quota of water vapour in swelling the error of the hydrogen figure. The hydrogen return will to this extent exceed the true content, and the whole series of allowances for moisture will be reflected upon the nitrogen content. The gas engineer who is furnished with an analysis is not told by what apparatus or method it has been carried out; and it is all the more necessary that the figures should show the actual facts—viz., the percentage of water vapour in the gas at the time of analysis. With these limitations in mind, it is now necessary to go into the question with the data available.

Properties of the Air Required and Products per Cubic Foot of Gas.

Each cubic foot of the gas, per analysis, would require for combustion 1·08532 cubic feet of oxygen, accompanied by 4·092 cubic feet of nitrogen—say, 5·2 cubic feet of dry air. More than this will in practice be admitted to the calorimeter; but as the excess beyond the theoretical behaves differently, it will be considered later. One cubic foot of gas presumably saturated, coming as it does straight from a wet meter, reacts with 5·2 cubic feet of air of unknown degree of saturation, producing exit gases consisting of 4·12 cubic feet of nitrogen, 0·49 cubic foot of carbon dioxide, and (if none had been condensed in the calorimeter), 1·24 cubic feet of water vapour. But as almost the whole of this water is condensed, the exit gases will be as stated, a total of 4·61 cubic feet, *plus* the saturation quota of moisture; against 1 cubic foot of gas and 5·2 cubic feet of air entering—a reduction in volume of 1·59 cubic feet. As the gas enters and the products leave saturated, the problem, so far as *humidity alone* is concerned, is reduced to a comparison of 5·2 cubic feet of air of x per cent. saturation, *versus* 3·61 cubic feet of products saturated. It will be noted that the preceding analysis will need to be corrected as to its influence on humidity, but will not materially affect the calculations to follow as to sensible heat.

Difference of Temperature between the Ingoing and the Outgoing Gases.

Sensible Heat.—As the quantity of heat attributed to combustion is upon the assumed condition of the exit gases leaving the calorimeter at the same temperature as the gas and air enter, so any deviation from the uniformity must be taken into account. The oorrection necessary will vary as to whether or not the theoretical quantity of air required is exceeded. Sections I., II., and III. of Table I. give data when no excess is supplied, and Sections IV. and V. when 25 to 50 per cent. excess.

The correction for sensible heat is strictly made up of two parts —(*a*) that due to the difference of the temperature of the gas as it enters the calorimeter and as its components leave in the waste gases; (*b*) similarly that for the air. These two, gas and air, will not often be at the same temperature; but an inspection of Table I. will show that by comparison the effect of (*a*) is very small, while that of (*b*) is about 96 per cent. of the whole. Section I. of Table I. shows that to raise the gas 1° C., weighing as

* See "Journal" for Dec. 21, 1909, p. 817, col. 1.

TABLE I.—*Heat Capacity of the Gas and Air Mixture, at 60° Fahr. and 30 Inches Mercury.*

Component.	Volume in Cubic Feet.	Weight in Grammes. Per Cubic Foot.	Weight in Grammes. Present.	Specific Heat by Weight.	Small Calories per Degree Centigrade.	Section.
Marsh gas . . .	0·324	19·312	6·2571	0·5929	3·7104	
Hydrogen . . .	0·497	2·414	1·1997	3·4090	4·0907	
Carbon monoxide .	0·099	33·796	3·3458	0·2450	0·8197	
CnHm	0·027	58·129	1·5695	0·4040	0·6341	
Carbon dioxide. .	0 021	53·108	1·1153	0·2163	0·2412	
Nitrogen . . .	0·030	33·796	1·0139	0·2438	0·2472	
Moisture (?) . . .	0·002	21·726	0·0434	0·4805	0·0208	
Totals and averages	1·000	14·5447	14·5447	0·67132	9·7641	I.
Oxygen	1·08532	38·6241	41·9194	0·2175	9·1176	
Nitrogen. . . .	4·09200	33·796	138·2932	0·2438	33·7141	
Moisture. . . .	0·08978	21·726	1·9506	0·4805	0·9373	
Totals and averages for air only . .	5·2671	34·585	182·1632	0·2402	43·7690	II.
Do. for gas and air	6·2671	31·387	196·7079	0·2721	53·5331	
Carbon dioxide. .	0·490	53·108	26·022	0·2163	5 628	
Nitrogen . . .	4·122	33·796	139·307	0·2438	33·961	
Moisture . . .	0·079	21·726	1·729	0·4805	0·831	
Products of combustion, no excess of air	4·691	35·608	167·059	0·2420	40·421	III.
Add 25 p. ct. excess of air	1·317	34·585	45·541	0·2402	10·942	
Products, ditto . .	6·008	35·383	212·600	0·2416	51·363	IV.
Add 20 p.ct. further excess	1·053	34·585	36·432	0·2402	8·754	
Products of combustion, 45 p. ct. excess of air . .	7·062	35·265	249·033	0 2414	60·117	V.
Products with 50 p. ct. excess of air	7·325	35·241	258·141	0·2413	62·305	

it does 14·54 grammes, and having a specific heat of 0·67132, 0·009764 Cal. is required. Section II. shows that to raise the 5·267 cubic feet of moist air, weighing 182·16 grammes, through 1° C., 0·04377 Cal. is required, or 4½ times that for the gas. Section III. shows similarly that to raise the minimum volume of products of combustion 4·6916 cubic feet, weighing 167·059 grammes, 0·04042 Cal. is required. This means that for every degree rise or fall of the exit gases, compared with the inlet, 1·25th of a Calorie correction is necessary. What then is the number of degrees that must be used as the multiplier? If the temperature of the gas be $\pm x$ degrees, and that of the air $\pm y$ degrees, different from that of the waste gases, then it would appear that the correct number would be $(0{\cdot}18x + 0{\cdot}82y)$; 9·764 and 43·77 being respectively 0·18 and 0·82 of the total heat capacity of the ingoing mixture—viz., 53·53 Cal. But this view probably attributes too much importance to the effect of the gas, because the products of combustion that escape are more nearly all derived from the air; for the hydrogen of the gas forms the water of condensation, and only the carbon goes into the exit gases, constituting 1·5351 out of the 5·6288 Cal. of the carbon dioxide. This represents but 1·535 ÷ 40·42 = 3·8 per cent. of the heat capacity of the products of combustion. By Section III. it will be seen that the total heat equivalent of the waste gases does not equal that of the air supply (Section II.). It is evident, therefore, that a very minute error only is incurred by leaving out the temperature of the entering gas, and regarding that of the air as the basis of computation. These figures, which are for the sensible heat alone, become accentuated as air in excess of theoretical needs is admitted. Thus in Section IV., with 25 per cent. excess, the amount would be 0·051 per degree, while with 45 per cent. (Section V.) it would be 0·06 per degree. The last one agrees with the estimate by Mr. Coste, when the products of combustion were assumed to be 7 cubic feet. But it is in contrast with 0·16 Cal. required by the Gas Referees' rule, which, however, most probably includes one or both of the factors next to be mentioned.

Latent Heat.—The incidence of this factor has two bearings—firstly upon the amount of moisture in the incoming gas *versus* that in the outgoing gases, even when both are saturated, and no change of temperature takes place; secondly, and similarly, when the temperatures thereof differ. Although the first is due to a shrinkage of volume due to chemical action, yet it is convenient to deal with it alongside the second. It will moreover reappear in the section dealing with change of humidity, and therefore must not be reckoned twice.

Firstly. The figures in Table I., for moisture in the gas will need here to be replaced by that normal to moist gas of 60° Fahr. The moisture entering is with gas 0·0172 cubic foot, and with air 0·0898 cubic foot—a total of 0·107 cubic foot = 2·324 grammes. Leaving it is 0·0796 cubic foot weighing 1·729 grammes—a difference of 0·274 cubic foot = 0·595 gramme. Taking the heat of vaporization at 60° Fahr. as approximately 0·61 Cal., 0·595 × 0·61 = 0·363 Cal. is the latent heat given up to the calorimeter, unduly raising the gross calorific value. It has the effect also of adding 0·595 gramme to the condensation water, making it appear that a greater quantity of hydrogen existed in the gas than was actually so; in other words, making the (true gross calorific value + error) − (true condensation value + error) = correct net calorific value, but making the heat calculated therefrom as due to hydrogen erroneous to the extent of the error just stated multiplied by 6·13. That is 0·363 × 6·13 = 2·22 Cal. = 8·8 B.Th.U. Or, making the calculation at once in B.Th.U., taking the difference between the gross and net calorific values of hydrogen as 53, we have for 0·0274 cubic foot of water vapour or hydrogen 1·45 B.Th.U. in lieu of 0·363 Cal.

Secondly. Change in the moisture content of the waste gases due to alteration of temperature, per degree centigrade. This is not equal for every degree of temperature, but around 60° Fahr. it increases its tension 0·03 inch of mercury for a rise of 1° C. This is equal to 1·9th of a cubic foot of water vapour per 100 cubic feet of gas = 0·001 × 21·726 grammes = 0·02414 gramme per cubic foot of air or gas. The problem thus becomes: Entering with 1 cubic foot of moist gas and 5·2 cubic feet of air, 6·2 × 0·02414 = 0·14963 gramme more moisture per degree centigrade rise leaving 4·622 cubic feet, containing 0·111575 gramme more moisture per degree centigrade rise. Assuming the variation to be the mean $\frac{0{\cdot}1496 + 0{\cdot}1116}{2} = 0{\cdot}1306$ gramme × 0·61 Cal. we get 0·08 Cal. as the latent heat of the changed water content.

For the sake of clearness, it may be desirable to embody these estimated corrections with the rule given by the Gas Referees in Table II.

TABLE II.—*Comparison of Gas Referees Rule, with Deviations occurring through Changes of Temperature.*

Source of Heat.	Calories Added to Calorimeter.		Calories Taken from Calorimeter.	
Sensible heat of exit gases	0·04 × 6 = 0·24		0·04 × 6 = 0·24	
Latent do., due to altered water content	0·08 × 6 = 0·48		0·08 × 6 = 0·48	
Do. due to shrinkage of volume of inlet air and gas . . .	Approximately constant, as explained below. 0·363			− 0 363
Gas Referees rule—1-6th cal. × 6° .	deducts	1·083 1·000	adds	0·357 1·000
Difference, after such correction . . .		0·083		0·643
Conditions under which gases leave relative to air and gas entering. . .	6° C. below, say 12·5° C. *versus* 18·5° C.		6° C. above, say 18·5° C. *versus* 12·5° C.	

It is noteworthy that in the first instance the Referees' correction meets the case, but in the other does not.

Within the figure given in Table II. as approximately 0·363 Cal., there is a factor which ought to be recognized, although its magnitude is small. It originates in the fact that water which enters with air or gas has a different heat contribution or abstraction from that which is condensed from steam at 100° C. To make this clear, the following particulars are necessary for comparison with the preceding calculation: The latent heat of vaporization at 60° Fahr. is 0·596 Cal., that at 100° C. being 0·5367 Cal., and the sensible heat from 100° to 18° = 0·082 Cal.—a total for the latter of 0·6187 Cal. It is impossible when the water is collected from the calorimeter to say how much is from the air supply and how much from the combustion; and all of it, according to rule, is computed on the latter basis. That from air, under the conditions set forth, would have the effect of 0·595 gramme × 0·596 Cal. = 0·355 Cal.; while that condensed from steam would have 0·595 × 0·6187 = 0·368 Cal. In other words, the air would give water yielding 0·013 Cal. less than credited in the condensation figure. It is with this explanation that the approximate figure of 0·363 is subsequently employed for both gross and condensation values. The correction under this head may need to be larger than is here given if the range of temperature is wide, and especially if it be initially high. The following values for the vapour tension of aqueous vapour will show the reason for it.

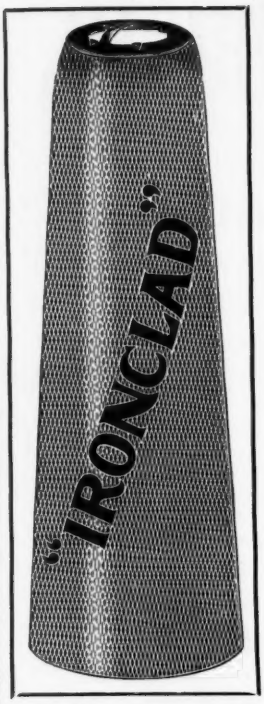
Deg. C.	Millimetres.	Deg. C.	Millimetres.	Deg. C.	Millimetres.
0·0 ..	4·57	15·0 ..	12·67	17·0 ..	14·40
5·5 ..	6·74	15·5 ..	13·09	25·5 ..	24·23
14·0 ..	11·88	16·0 ..	13·51	30·0 ..	31·51

Thus 10° C. above 15·5 C. (or 60° Fahr.), adds 11·14 mm. of mercury to the vapour tension, while 10° C. below that datum only takes away 6·35 mm. Some such influence probably operated in the abnormal condensation values observed with London mixed gas, shown later in Tables XVI. to XVIII.

(To be continued.)

The London and Southern District Junior Gas Association will pay a visit to-morrow (Wednesday) afternoon to the mantle works of the Voelker Lighting Corporation, at Wandsworth. This will be followed on the 25th inst. by a paper by Mr. P. G. Somerville, of the Gaslight and Coke Company, on "The Incandescent Mantle; having Special Reference to the Use of Non-Collodionized Mantles." As already announced, the second annual dinner will take place on March 5, at the Horse Shoe Hotel.

THE



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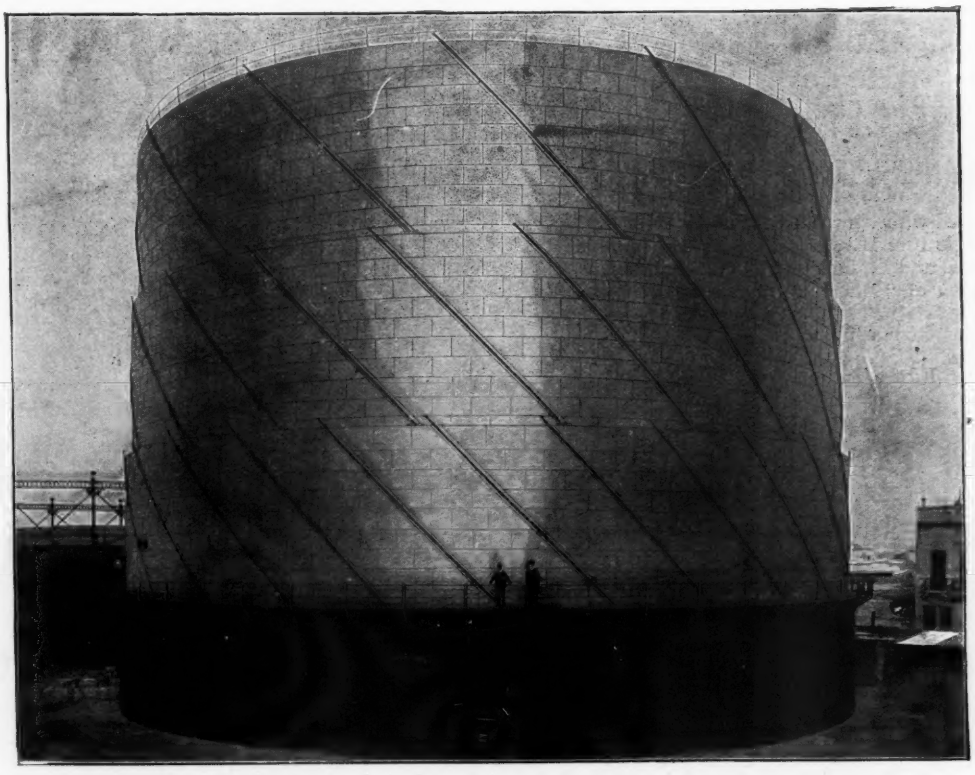

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THE FLOW OF GAS THROUGH PIPES.

By D. CHANDLER, of the South Metropolitan Gas Company.

[IN reference to the following article, Mr. Charles Carpenter writes: The increasing importance of the "outdoor" department as a necessary adjunct to the "indoor" one (I use the words in the sense usually applied by gas men) leads me to think that some experimental data upon the subject of the flow of gas through small orifices and pipes may prove useful and interesting to your readers. The original experiments were made for me some years ago; but I have had them repeated, under even more careful conditions, by Mr. D. Chandler, who has also, at my request, written a short introduction to them. If you think my view of their usefulness is correct, they are quite at your disposal for publication.]

IN June, 1852, the "JOURNAL" published a paper by Dr. William Pole, on the "Motion of Fluids in Pipes," in which were set forth the general laws and principles governing the flow of fluids through pipes. After stating that the friction of fluids upon solids depends on laws altogether different from those which regulate the friction of solids upon each other, Dr. Pole expressed the opinion that the following principles might be considered sufficiently well established for the purpose of constructing a formula affecting the discharge of gas from pipes.

1.—The friction of a fluid upon a solid is independent of the hydrostatic pressure to which the fluid is subjected. Thus the friction of water passing along a pipe under a pressure of 100 lbs. per square inch is no greater than if the pressure were 1 lb.

2.—It is proportional to the area of the rubbing surface. Thus the friction of water in passing along a pipe 100 feet long would be twice as great as if the pipe were only 50 feet long; or if the circumference of a pipe be doubled (the length remaining the same), the friction would be doubled in like manner. If, therefore, L be made to represent the length of a pipe, and C its internal circumference, the friction will be proportionate to LC.

3.—It varies with the velocity; but in what ratio it does not appear to be well determined. As a simple rule, however (near enough for practical purposes), the friction may be assumed to vary as the square of the mean velocity with which the bodies move upon each other, or as V^2. Thus, if the velocity of water passing along a pipe be doubled, the friction will be increased fourfold, and so on.

4.—It may also be assumed to be proportional to the specific gravity of the fluid, or will vary as S. The friction does not appear to be dependent in any other respect upon the nature of the two substances in contact, provided only that the fluid be in a perfect state of fluidity, and that the surface of the solid be so smooth as not to offer obstructions to the passage of the fluid along it.

COEFFICIENT OF FRICTION.

Dr. Pole stated that, while these laws supplied the bulk of data necessary to construct a formula which would determine the force required to overcome friction by the passage of a fluid of known gravity through a straight pipe of given diameter and length, one element was missing, which could only be determined by actual experiment—viz., the important factor, coefficient of friction—respecting which theory gives no information. To determine this factor, Dr. Pole took four experiments, each made under very different conditions—viz., two on water, one on air, and one on gas. It is somewhat surprising to find (since so much depended upon this element) that Dr. Pole did not make careful experiments himself, but wholly relied upon data obtained from four experiments which, so far as one can gather, were made under ordinary working conditions, and with which no special precautions were taken to ensure the greatest possible accuracy.

The first experiment taken was made by Smeaton, at the Edinburgh Water-Works, upon a 4½-inch pipe, 14,637 feet long, delivering water at a velocity of 1·85 feet per second, under a differential pressure of 22·35 lbs. per square inch. From these data, Dr. Pole obtained the factor 0·0001 as friction coefficient. The data for the second calculation were obtained from an account given by Mr. Provis of an experiment upon a 1½-inch pipe, 100 feet long, delivering water at a velocity of 2·72 feet per second, under a differential pressure of 1·08 lbs. per square inch. The friction coefficient was nearly 0·0001. The third factor was obtained from an experiment made upon the flow of air through a pipe 0·62 inch diameter and 279 feet long, by M. Girard, of Paris. The differential pressure was 6·93 lbs. per square foot, and the velocity equalled 6·93 feet per second. The friction coefficient was 0·00009. The fourth example was taken from particulars of an experiment quoted by Mr. Hawksley, made at the Chartered Gas-Works, Westminster, upon an 18-inch main, 1 mile long, delivering gas at a velocity of 10·4 feet a second, under a differential pressure of 1 inch water column. The coefficient of friction was 0·00011.

Taking the maximum and minimum of these four factors, it will be seen that the greatest coefficient is 9·1 per cent. above, and the lowest 10·0 per cent. below, the mean; or, stating the case in another way, there is a total variation of 19·1 per cent. from minimum to maximum factor. However, Dr. Pole assumed the mean 0·0001 to be the correct figure for all practical purposes; and from it he deduced the constant 1350 in the well-known formula

$$Q = 1350\, d^2 \sqrt{\frac{h\ d}{s\ l}}$$

From the foregoing *résumé* of Dr. Pole's paper, it will be seen that the value of the formula given by him can only be said to have been demonstrated within the limits of the experiments quoted; and therefore under other circumstances the formula might not be so reliable. As a matter of fact, Dr. Pole himself subsequently quoted results obtained upon water, air, and gas, in which considerable discrepancies are shown; and the Editor of the "JOURNAL" inserted a footnote to the effect that a large and valuable set of experiments on the discharge of coal gas through a 9-inch main, 1125 yards long, under varying pressures, gave results, on the average, about 15 per cent. less than the calculated volume, which would require the constant 1350 to be reduced to 1150.

From this it would appear that while the formula devised by Dr. Pole may be sufficiently accurate under certain conditions, it cannot be entirely relied upon under all circumstances of straight running pipes.

Subsequently to the publication of Dr. Pole's paper, Mr. Thomas G. Barlow published in the "JOURNAL" a series of tables constructed from the formula, on the discharge of gas, in cubic feet per hour, through pipes of various diameters and lengths, and under various pressures—taking for the smallest size a service 0·5 inch diameter, giving the volumes discharged (specific gravity = ·4) through a range of differential pressures from 0·1 to 0·5 inch water pressure. Later, the tables were extended by Mr. Newbigging to a differential pressure of 2½ inches.

NEW EXPERIMENTAL RESULTS.

It has long been a question as to whether this formula applies for small services. But since Dr. Pole did not specify any particular working limits, and results have never been published actually disproving its applicability for small diameters, it has been generally relied upon for practical purposes. The author having occasion to check the results according to formula by actual experiment on a 50 feet run of ½-inch compo. service, surprising results were obtained, which, if correct, demonstrate that for small pipes the formula is hopelessly inadequate and misleading. [See Table I.] It will be seen that the results are not only interesting from the actual discrepancy revealed between practice and theory of volume discharged, but surprising because they demonstrate that, under certain conditions, the fundamental laws upon which Dr. Pole's formula is constructed are inoperative.

TABLE I.—*Volume of Gas per Hour from ½-Inch Compo. Pipe, 50 Feet Long (Sp.G. ·425).*

Pressure, in Tenths.	Volume by Experiment at N.T.P.	Volume by Formula, $Q = 1350\, d^2 \sqrt{\frac{hd}{sl}}$.
	Cubic Feet.	Cubic Feet.
1	9·32	28·40
2	19·80	40·16
3	29·42	49·27
4	37·94	56·70
5	46·50	63·40
6	52·98	69·60
7	61·68	75·00
8	66·94	80·30
9	68·88	85·00
10	71·80	89·70
15	86·01	109·70
20	98·66	126·90
25	110·43	141·80
30	122·98	155·30
35	133·39	167·70
40	144·49	179·30

So interesting was this discovery, that further experiments were made to ascertain, if possible, the principles affecting the flow of gas through small pipes and services.

The results obtained upon varying lengths of ¼-inch, ⅜-inch, and ½-inch compo. pipe clearly show that these laws are totally different from those employed by Dr. Pole, within certain limits of pressure, diameter, and length. The facts demonstrated, within the range of experiments made, are:

1. For service-pipes, the constant embodied in Dr. Pole's formula is much too large.
2. For small differences of pressure, the law that the volume discharged varies as the square of the pressure is not operative; the volume, apparently, within certain limits, varying directly as the pressure.
3. The law that volume discharged varies inversely as the square of the length does not apply with small differences of pressure and all lengths of service.

These results are most important from a practical point of view, and show that implicit confidence in long-established and generally-accepted formulæ is sometimes misplaced. But, apart

TABLE II.—*Cubic Feet Discharged per Hour at N.T.P.*

A.—¼-inch Compo. Pipe. B.—⅜-inch Compo. Pipe. C.—½ inch Compo. Pipe.

Pressure, in Tenths.	A. Length of Pipe. 50 Feet.	A. 25 Feet.	A. 12·5 Feet.	A. 6·25 Feet.	B. Length of Pipe. 50 Feet.	B. 25 Feet.	B. 12·5 Feet.	B. 6·25 Feet.	C. Length of Pipe. 50 Feet.	C. 25 Feet.	C. 12·5 Feet.
1	0·81	1·20	2·01	3·88	2·69	5·23	9·72	18·34	9·32	18·06	35·24
2	1·42	2·41	4·43	7·97	5·78	11·85	18·79	35·67	19·80	37·09	61·17
3	1·83	3·56	6·55	11·89	8·44	16·47	28·19	43·15	29·42	51·26	73·99
4	2·44	4·53	8·47	14·43	10·60	20·73	37·51	51·78	37·94	66·80	83·89
5	3·05	5·61	10·49	18·13	13·88	25·58	42·34	58 54	46·50	72·63	93·21
6	3·66	6·78	12·91	22·27	16 58	29·65	48·10	62·29	52·98	76·32	103·89
7	4·37	8·07	14·73	24·38	19·28	33·43	52·46	66·17	61·68	81·56	113·25
8	4·99	9·91	15·74	26·95	21·74	37·79	53·12	73·07	66·94	86·89	123·12
9	5·74	10·49	16·74	28·86	23·90	42·57	56·96	78·25	68·88	91·99	129·80
10	6·29	11·30	20·38	31·59	26·85	44·76	58·82	83·47	71·80	97·10	137·06
15	9·24	16·46	28·25	38·07	37·67	54·07	73·65	105·29	86·01	122·34	164·00
20	12·10	21·84	34·03	44·48	47·14	60·73	87·74	123·32	98·66	143·70	192·00
25	16·03	27·09	36·14	51·30	51·35	69·69	99·80	138·81	110·43	157·00	214·00
30	17·67	30·99	38·95	56·11	54·07	76·54	108 89	154·87	122·98	170·00	236·00
35	20·09	33·43	42·16	61·84	57·75	82·90	117·50	169·21	133·39	184·00	256·00
40	23·16	34·65	46·18	66·73	62·01	89·07	129·60	182·40	144·49	195·00	274·00

from the practical value of the experiments, a most interesting field for theorizing is afforded by the figures obtained.

Some light may, perhaps, be thrown upon the flow of fluids in pipes when it is remembered that skin-friction is not the only element to be counted with. Viscosity or internal molecular friction may play a most important part. Dubuat found, in the case of water, that viscosity gave an additional resistance, increasing as the simple power of velocity; and Dr. Pole pointed out its effect by stating that the particles of a fluid move faster at the centre of a pipe than at the circumference.

VISCOSITY AND VELOCITY.

The importance of viscosity as affecting the flow of water in pipes, &c., has been recognized since the problems of hydrodynamics were first investigated. Dr. Ernst Mach, in his work on the "Science of Mechanics," asserts, in dealing with the question of liquid motion, that when the enormous effects of viscosity are taken into account, anything like dynamical solution of almost every problem is out of the question. If, therefore, its influence is so important in the matter of hydraulics, can we believe that its effect may be altogether ignored in the motion of gases? May we not reason that layers of gas travel in a pipe with increasing velocities towards the centre, and continually interchange molecules by diffusion, with loss of momentum, due to internal work, the ultimate effect of which might be increased temperature of the flowing gas?

If this is the case, we can believe that the effect of viscosity would be greater in pipes of large sectional area than in small services, since with the latter the skin area exposed is greater per unit volume of gas. In the case of a pipe 0·5 inch diameter, the ratio of skin-surface to capacity is 1 to 0·125; while in the case of a 12-inch pipe, it is 1 to 3. Therefore the velocity in small pipes would have to be greater than in large mains for the same pressure volume law to be operative. This, after all, is only another way of stating what the text-books on mechanics assert—viz., that critical velocity depends upon the size of pipe. If this reasoning is tenable, it is obvious that each size of pipe has its own particular limits, within which the laws upon which Dr. Pole's formula is framed hold absolutely good.

Having suggested that discrimination should be made between actual skin friction and internal molecular friction or viscosity, the remaining point to be emphasized, as affecting the motion of fluids in pipes, is that of velocity. And here the work of Professor Osborn Reynolds throws much light upon the problem.* Professor Reynolds has shown that there exists a certain relationship between velocity, V, and diameter, B, of any sized pipe for any given fluid, which causes a definite velocity, V, to be critical. So that for values below the critical V the flow of a fluid is in straight, continuous streams; but when the particular velocity is exceeded, the steady equilibrium is destroyed, and sinuous motion characterizes the flow. This was actually demonstrated by Professor Reynolds, with an experiment upon the flow of water coloured with an aniline dye. Below the critical velocity, the water flowed in a steady, straight-line stream; at the critical V, the coloured water suddenly broke up into smoke-like eddying clouds.

If we, therefore, take a given length and size of pipe, and allow gas to flow through under differential pressures ranging from (say) 0·1 inch water pressure up to 100 inches, there may be several points in the scale where a certain velocity becomes critical, requiring a change of law at each particular point. As John Perry has stated, with a fluid flowing at the velocities 1, 2, 3 feet per second, the friction is proportional to 1, 2, 3; whereas at the velocities 1, 2, 3 yards per second, the friction may be proportional to 1, 4, 9, &c. "Thus the friction in fluids is proportional to the speed when the speed is small; to the square of the speed when the speed is greater; and at still greater speeds the friction increases more rapidly than the square of the speed."

* Phil. Trans., Royal Society, 1883, Part III.

TABLE III.—*Cubic Feet Discharged per Hour at* N.T.P.

D.—GAS-BARREL, ¼-INCH BORE.

Pressure, in Tenths.	Length of Pipe. 40 Feet.	20 Feet.	10 Feet.
2½	1·63	3·47	7·65
5	3·67	6·55	14·00
7½	5·20	10·52	21·18
10	7·14	13·70	24·13
12½	8·56	17·09	28·25
15	10·40	19·82	31·54
17½	12·24	22·68	34·84
20	13·46	24·95	37·08
22½	15·30	27·22	38·14
25	16·76	28·65	39·55
27½	18·39	29·19	41·28
30	19·92	30·38	42·89
32½	21·46	31·10	44·35
35	22·68	32·17	46·80
37½	23·91	33·96	48·36
40	24·83	35·64	49·93

TABLE IV.—*Cubic Feet Discharged per Hour* at N.T.P.

E.—⅜-INCH BRASS TUBE.

Pressure, in Tenths.	Length of Pipe. 4 Feet.	1 Foot.	Pressure, in Tenths.	Length of Pipe. 4 Feet.	1 Foot.
1	0·25	1·22	13	3·30	9·54
2	0·60	2·32	14	3·60	10·26
3	0·80	3·42	15	3 75	10·84
4	1·10	4·20	16	4·00	11·12
5	1·40	5·07	17	4·20	11·56
6	1·60	5·79	18	4·30	12·14
7	1·90	6·36	19	4·50	12·71
8	2·10	6·50	20	4·65	13·45
9	2 40	8·09	25	5·60	15·00
10	2·60	8·24	30	6·45	16·77
11	2·80	8·67	35	7·35	18·50
12	3·00	9·24	40	8·00	19·08

TABLE V.

F.—ORIFICE 0·055 INCH DIAMETER.

Pressure, in Tenths.	Cubic Feet per Hour at N.T.P.	Pressure, in Tenths.	Cubic Feet per Hour at N.T.P.
1	1·17	13	4·13
2	1·67	14	4·28
3	1·96	15	4·42
4	2·30	16	4·62
5	2·64	17	4·76
6	2·88	18	4·86
7	3·10	19	4·96
8	3·38	20	5·05
9	3·52	25	5·74
10	3·66	30	6·27
11	3·80	35	6·69
12	3·96	40	7·08

DESCRIPTION OF EXPERIMENTS AND RESULTS.

The first set of experiments, A, B, C [Table II.], were made to determine the flow of gas under varying pressures through different lengths of ¼-inch, ⅜-inch, and ½-inch compo. pipe. The volumes discharged per hour were obtained for each 1-10th inch increase of pressure up to 10-10ths, and from 10-10ths up to 40-10ths in increments of 5-10ths of an inch. The pressures were taken with a delicately-adjusted King's gauge, and the volume discharged obtained by direct reading from a test holder (20 cubic feet capacity) certified by the Board of Trade. The terminal end of the pipe, in every case, was open to atmosphere. All volumes are reduced to 30 inches bar. 60° Fahr.; gravity of gas, ·425.

TABLE VI.

G.—ORIFICE ¼ INCH DIAMETER.

Pressure, in Tenths.	Cubic Feet at N.T.P.	Pressure, in Tenths.	Cubic Feet at N.T.P.
2½	11·84	22½	37·57
5	16·69	25	39·99
7½	20·64	27½	41·75
10	24·24	30	43·93
12½	28·17	32½	45·45
15	30·90	35	47·57
17½	33·02	37½	48·78
20	35·75	40	50·29

An experiment D [Table III.], was carried out on precisely the same lines for various lengths of ¼-inch bore iron barrel. The volumes were obtained for increments of 25-10ths pressure.

Experiment E [Table IV.] was made on $\frac{3}{16}$-inch brass tube, and volumes obtained for every 1-10th increase of pressure. Experiments F and G [Tables V. and VI.] were made to determine the flow of coal gas through (1) an orifice 0·055 inch diameter and $\frac{3}{1000}$ inch thick; (2) an orifice ⅛-inch diameter and ¼-inch thick. In the case of gas discharged through orifices, it will be seen that the generally accepted law holds good, even for small differences of pressure.

THE USE OF TAR FOR ROADS.

At a Northern District Meeting of the Institution of Municipal Engineers which was held recently, Mr. WILLIAM WADE, Divisional Surveyor to the Northumberland County Council, read a paper on the "Use of Tar for Road Making and Repairs." In the course of the paper (which was adjourned for further discussion at a meeting to take place at Newcastle-on-Tyne next Saturday), the author made the following observations.

The concensus of opinion from many and varied sources seems to indicate that some combination of tar and pitch is, as yet, the best means of combining the varied kinds of stone used in road making. There are, broadly speaking, three methods of applying the tar: (1) Tar-painting, or waterproofing the surface. (2) Tar macadam, or mixing tar with the stone previous to its being laid on the road. (3) Tar-grouting, or grouting the stone with tar and pitch when the road is being coated. Each of these methods possesses its own distinctive features, though the ultimate aim is the same in all cases—viz., that of binding the stone firmly together, and preventing the wear and tear which arises from the disturbance of the crust owing to weather and the traffic.

TAR-PAINTING.

Tar painting may be used on either an ordinary road prepared under the old method, or upon a new stretch of metal. In the case of tar-painting a stretch of road which has carried traffic for some time, it is essential that all dust should be removed from the road before the liquid is applied. After the removal, the road is ready for the application of the tar, which is heated in tanks of various sizes. These tanks are fitted with distributors or jets; and tar at the proper temperature is applied by pressure so as to secure a certain amount of penetration as well as equal distribution. The tarred surface has then granite, spar, or other suitable screenings sprinkled over it.

The cost of tar painting works as follows: One gallon of tar will cover an area of from 10 to 20 square yards, at a cost of from 1d. to 1½d. per square yard.

TAR-MACADAM.

I have now to deal with the second method—that of thoroughly mixing the stone with tar and pitch previous to its being laid on the highway. This is, perhaps, better known as tar-macadam. As it is absolutely essential that all stone should be perfectly dry and free from moisture, a shed or some covered-in structure will materially help in getting the work done in a speedy and efficient manner. The stone used is of three sizes—2½-inch, 1½-inch, and ½-inch—and should be free from dust and moisture. The tarring may be done by hand or by machinery. The latter method is much cheaper; and I find that machine-tarred stone is superior to that mixed by hand. After the stone is tarred, it is stacked in separate heaps. The best results are obtained when the tarred material is allowed to be undisturbed for from one to three weeks before it is applied to the road. The proportion of pitch must be greater for the bottom coat than for the two succeeding ones.

The 2½-inch stone is first put on the road foundation. Above this the 1½-inch is placed, and the ½-inch is used as a finishing coat, over which is sprinkled ⅜-inch of dry granite screenings free from dust. Each layer of stone is well rolled before the one above is put on. It is very necessary that more than ordinary care should be taken in the consolidation of the separate layers. When completed, the combined thickness of the three coats gives an average depth of 4 inches; the depth of material, of course, being greater in the centre than on the sides of the road. A 15-ton roller is preferable, especially if the traffic be heavy; for if a light steam-roller be used, when traffic heavier than the roller passes over the road the result will, in all probability, be disastrous for the road. One ton of tarred stone will cover an area of 6 square yards; and the average quantity of tar required for a ton of stone is 8 gallons, and 20 lbs. of pitch.

The 8 miles of tar-macadam laid by the Northumberland County Council cost on the average 2s. 2d. per square yard, inclusive of mixing plant, &c. The roads treated were structurally weak—a penned bottom of 6 inches of whinstone was laid down on the existing road to give a good foundation, on which the tarred stone was placed. Good drainage and strength of structure are important factors in the laying down of a successful tar-macadam roadway.

The cost of reconstructing a road by means of penning it with 6 inches of whinstone varies from 10d. to 1s. 6d. per square yard, according to the distance the stone has been brought.

TAR-GROUTING.

Now I come to deal with the third method—that of tar-grouting the stone with tar and pitch when the road is being coated. Before beginning tar-grouting, it is necessary to take into consideration the weight of loads and the nature of the traffic the road is likely to be called upon to carry. This will altogether determine the size of the broken stone, its quality, and the thickness of the coat to be laid on the surface. On roads that carry heavy traffic, 3 inches of hand-broken whinstone should be used, while on those where there is no motor waggon or locomotive traffic, I would recommend 2½ inches.

After the stone is laid on, it is slightly rolled. The pitch and tar are together heated in tanks to boiling point; and a quantity of creosote oil is added. Stirring is necessary to enable the ingredients to be thoroughly well assimilated. The boiling matrix is poured in the interstices by means of a specially made can and distributor. Each individual stone is thus thoroughly well grouted and embedded in, or surrounded by, the mixture. While still hot, ⅜ inch of slag or whin chippings are applied and properly consolidated with a 15-ton roller until an integral crust is formed.

ADVANTAGES AND DISADVANTAGES.

Tar-painting may with great advantage be used on suburban roads where the traffic is light, or where the dust nuisance is greatly felt and watering has to be resorted to. The tar acts as a protection, and protects the life of the road surface so long as it is dry. It has this great drawback—being only externally applied, it breaks up in wet weather, and the combined action of the wheels and horses' feet soon put the roads into an uneven and dirty condition. This, of course, applies to roads where the traffic is heavy. To sum up, tar-painting is not to be compared with either tar-macadam or tar-grouting as far as lasting properties are concerned. The tar in this case is not so much a binder as a protection to the road surface.

Tar-macadam possesses the following main advantages: (1) The small stone of which the crust is composed being well tarred before being laid on the road, gives a compact and smooth surface. (2) The tar-macadam road is perfectly sanitary and almost dustless, so that cleansing is reduced to a minimum. (3) It is easily repaired, and the cost of maintenance is 30 per cent. less than that of ordinary macadam. For motorists it is an ideal road.

Tar-macadam is not without its drawbacks. The chief of these, so far as road authorities are concerned, is heavy initial cost. From the point of view of those using the road, the slippery nature of the surface, especially during hoar frosts, is an objectionable feature. However, this remedies itself in course of time by the tar gradually leaving the road dry by evaporation. Locomotive traffic tends to cause the top layer, which is only 1½ inches in thickness, to become separated from the layer below. This, of course, means the break-up of the road so far as the crust is concerned. This is the reason why tar-macadam is not adapted for heavy loads.

Tar-grouting differs from tar-macadam in these respects: (1) By broken stone being applied in one coat. (2) The stone is of a uniform size. (3) Owing to a larger quantity of pitch being mixed with the tar, the mixture quickly solidifies, and adhesion is instantly secured, in much the same way as is done in wood or granite paving.

The Northumberland County Council have this year tar-grouted 15,436 tons of broken stone on a stretch of upwards of 14 miles of main road in various parts of the county. This work can be carried out satisfactorily by doing half of the road at a time. I did not receive a single complaint while the work was in progress. Furthermore, there was an entire absence of loose stones—generally an annoying feature on ordinary newly-rolled patches. In September last, I supervised the work of making the road approaches over a new bridge. Clay was used in order to bring the roadway to the required level. You are all aware of the difficulty of making a satisfactory highway over newly-filled clay. Yet, after these approaches had been penned with rubble whin, and then coated with 2½ inches of hand-broken whinstone, I found that by tar-grouting I was enabled to get a firm and permanent road at once. The cost of tar-grouting is no more than that of repairing a road by the old water-bound method.

A tar-grouted highway is, as yet, the nearest approach we have to an ideal road. It is certainly for mixed traffic superior to the other methods I have mentioned. Yet, at the same time, I must not omit to say that the surface is not quite so suitable for motors as that of tar-macadam.

CONVERTING GRATE-BAR FURNACES INTO REGENERATIVE SETTINGS.

A patent has lately been taken out for France by MM. Charles M. Stein et Cie. for a method of converting ordinary grate-bar furnaces into regenerative settings; and it is claimed that the alteration can be made so as to preserve entirely the piers and vault of the ordinary setting, and combine them with a producer charged through a door located in the same place as the door of the old furnace.

In the practical application of the invention, the gas-producer, which is combined with a setting of the ordinary direct-fired type and from five to eight retorts, is vaulted, which allows the burners to project into small combustion chambers formed by the intervals between two rows of retorts—an arrangement which prevents the burning of the latter. The invention also includes a special construction of stoneware fittings employed in the regenerator in combination with the producer; and likewise a special arrangement of the top of the central part of the pit of the producer. The stoneware is intended to ensure perfect regeneration with furnaces of small dimensions; and the object of the arrangement of the top is to facilitate scurfing and the stirring of the contents of the producer.

Fig. 1.

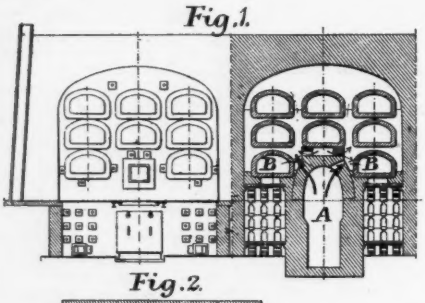


Fig. 5.

Fig. 2.

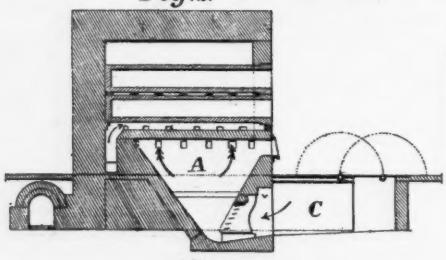


Fig. 6.

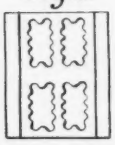


Fig. 3.

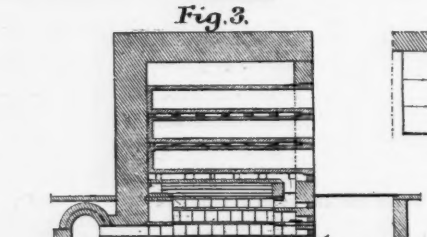
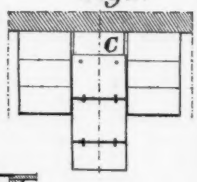


Fig. 4.



The accompanying diagrams illustrate the application of the invention. Fig. 1 shows an elevation and a transverse section of the furnace; fig. 2, a section through the axis of the producer; fig. 3, a section through the axis of one of the two recuperators; fig. 4, a plan of the top of the pit; figs. 5 and 6 are an end view and a plan of one of the pieces of stoneware.

As shown in fig. 1, the producer A has a high vault, allowing the burners to enter the small combustion chambers B. The recuperators are placed on each side of the producer, and are furnished with the stoneware fittings already mentioned, which have in them holes with corrugated sides, as shown in fig. 6. The producer is charged through a door situated in the same place as the old furnace door. The pit C has a cover of fluted sheet iron, with three lids or flaps, one of which (that to the right in fig. 2) is fixed, while the others are movable and united by rings as shown. The lids can be opened so as to leave the top of the pit completely free. The sides are covered with cast-iron plates, which are removed when cleaning the regenerator. The single-headed arrows show the courses of the primary and secondary air; the double-headed ones, the path of the gases.

The invention is not confined to the structural details of the setting represented; and the accessory arrangements can be altered to meet different cases which may arise in practice.

The death occurred on the 30th ult., in his 69th year, of Mr. John C. Mortimer, who was for some thirty-eight years one of the collectors of the Gaslight and Coke Company.

RELATIVE ADVANTAGES OF GAS & ELECTRICITY

Notes by Mr. J. R. Hill, of Manchester.

Owing to want of time, Mr. J. R. Hill, Superintendent at the Bradford Road Gas-Works, Manchester, did not have a chance of submitting his views when the relative advantages of gas and electricity came up for discussion at the last meeting of the Manchester Association of Students of the Institution of Civil Engineers, held at the Chartered Accountants' Hall in the city. The following are extracts from the notes prepared by Mr. Hill on the subject.

We claim that gas can more than hold its own against electricity for heating, cooking, and public and private lighting, and in most cases for power. It is of excellent service for ventilation, is quite as safe as, if not safer than, electricity, and the numerous methods and ways in which it can be used render it a most desirable servant. In heating and cooking, electricity is not a serious competitor. It is generally accepted that 6 cubic feet of gas contain as many heat units as one B.T.U. of electricity, which explains why this is so. One or two of the London restaurants did, as a novelty, fix electric grillers; but I think even the most ardent electrician, if he were hungry, would put his steak under a good gas-griller in preference to placing it either under or over a red-hot hair-pin.

When gas enters into fair competition with electricity for street lighting, the former comes out the victor in practically all cases, be it on the low or be it on the high pressure system. Bradford, among other towns, has had what may be termed competitions between the two systems, both the gas and the electrical engineers being empowered to make the best of their respective methods of lighting in given stretches of road; and gas, as usual, emerged the victor. London sent the Chairman and other members of the Lighting Committee to the Continent to inspect and compare costs; and their report was in favour of gas. The Inspectors of the Local Government Board have frequently of late drawn the attention of those responsible to the cheaper and better light that can be obtained from gas; and in many cases they have gone so far as to refuse loans. In Liverpool, though the electricity works are owned by the Corporation and the gas is supplied by a Company, they are quite content to go on using gas for street lighting, well knowing it to be the cheaper. Not only in street lighting does gas still excel its competitor, but also for large open or partly covered spaces—such as railway stations, &c. Several of the large railway stations in and around London are being lit by one or the other system of gas lighting. Another notable case is the Nottingham Market, the authorities of which have now decided, after a test of some weeks' duration, to discard sixteen 1000-candle arc lamps in favour of sixteen 3000-candle high-pressure "Selas" lights; and, by doing so, they will not only get three times the light, but also save about £250 per annum.

Mr. Robinson's allowance for mantles for interior lighting is most excessive. My own experience is a much longer average life. The figures given by Mr. Robinson for electric lighting are not competitive ones, but are taken from laboratory practice, and are hardly likely to be found applicable to ordinary everyday working. This view is confirmed by a paper read before the Birmingham electrical engineers a month or two ago, in which the cost of metallic filament lamps per 1000 candle-hours, including allowance for renewals (in laboratory experiments), was found to vary with different lamps from 5·6d. to 8·8d., with electricity charged at 4d. per unit. Altering the rate to the standard given for the purposes of the discussion, the cost for 60 candles, 1000 hours burning, would be from 21s. to 33s.—an average of 27s.—against his figures of £1 4s. 3d.

For large rooms, shops, &c., high-pressure lighting is coming more and more into vogue; the lamps being operated from switchboards, so that such parts only as are required may be illuminated. And as flame arc lamps are inadmissible for the work, owing to their "fragile" nature, metallic filament lamps are found unsuitable, and in place thereof gas-mantles are used. For ordinary dwellings, the inverted lamp has come to stay. The careful and economic housewife has a rare choice of burners, varying in size from the small bijou, consuming 1 to 1½ feet per hour, and giving a light of 25 to 30 candles, to the full-sized burner, consuming between 3 and 4 feet per hour, and giving a light of 70 to 80 candles. To suit these, a large and varied assortment of shapes, sizes, and colours of globes and shades can be had; and these, together with the modern artistic, good fittings, make it possible to suit all tastes, fancies, and styles of decoration. As to the cost of running these small burners, it will be found, on the figures given, that electricity would have to be sold below ¾d. per unit to compete.

From the ventilation and health point of view, gas has its uses, more especially in large rooms, for the heat set up by the burning gas puts the air in motion, and by suitable ventilators in the ceiling the atmosphere is kept pure and sweet. The stuffiness of small rooms, about which so much has been said, is more a relic of old times when three or four large flat-flame burners, consuming 15 to 20 feet per hour, were in use, and did not give the light now secured by a single burner consuming 3 to 4 cubic feet. The cry of sulphur from the gas is also a favourite one; but this, independent of the large mass of evidence that has of late years been collected, falls to the ground, when it is remembered that

about 20 cubic feet per hour used to be consumed against between 3 and 4 feet now.

Referring to the discussion, the "Manchester Guardian" last Saturday said: "In the course of an argument in favour of gas, Mr. F. H. Robinson quoted £6 5s. as the cost of 180-candle power of gas for 4000 hours of street lighting, and £13 2s. as the cost of similar lighting with electricity. 'In future,' he added, 'all the streets in Berlin are to be lighted with high-pressure gas; and the total cost of 60-candle power gas lighting for 1000 hours is 10s.; while for electricity it is £1 4s. 2d.' Believing there was something wrong in the statement about Berlin, a Manchester correspondent wrote to Dr. Klingerberg, one of the best known electrical engineers in Berlin, for information, and has received a reply in which Dr. Klingerberg says: 'In reply to your inquiry, I beg to say that there is no question of substituting high-pressure gas for electric light in Berlin. On the contrary, a decided increase in lighting by flame arc lamps is to be expected. At the same time, high-pressure gas lighting is extensively used and adopted in the streets which have hitherto been lighted by gas. The adoption of high-pressure gas lighting instead of electric light is, primarily, to be accounted for by the fact that the gas-works are under municipal control, and the city of Berlin, therefore, takes an active interest in their development; while the electrical supply for the city comes through a private company."

THE HEAVY RARE METALS.

In the course of a paper on "The Relation between the Mineral and the Chemical Industries," read by Mr. G. T. Holloway before the London Section of the Society of Chemical Industry on the 3rd ult., he made the following remarks.

The occurrence together of practically all the heavy rare elements, and the almost invariable occurrence with them, or at any rate in the same or similar rocks, of many of the rare alkali, alkaline-earth, and allied elements—such as lithium, caesium, rubidium, cerium, thorium, didymium, beryllium, zirconium, &c.—is of extreme interest. All occur in pegmatites or others of the oldest, and particularly the acid, rocks; and practically none are found elsewhere, except under conditions directly traceable to such an origin. Where uranium abounds, the other heavy metals are usually present in comparatively small quantity, and the other groups of rare elements are practically non-existent; while under conditions where uranium is absent, or only found in comparatively small quantity, the others may be found associated together, either as components of minerals of complicated constitution or each in its own characteristic mineral form.

It is extremely probable that there is a definite connection between these occurrences and the birth or decomposition of the elements, and that a study of them may elucidate many doubtful points more simply and conclusively than attempts, however well directed, to artificially produce results which Nature has already achieved. The occurrence of fluorides with these rare metals, or in the rocks where the same occur, is also of importance. Both fluorspar and cryolite are commonly, although by no means always, associates of them; and it is considered by many that these fluorides, which often occur in fissure veins in granites, diorites, gneisses, &c., of great age, have been produced in many cases by the action of metallic fluorides whose decomposition has resulted in the production of metalliferous deposits.

The peculiar action which the heavy rare metals have when added to steel shows how curiously they stand as a class distinct from others. Uranium, tungsten, molybdenum, tantalum, niobium, vanadium, and even titanium, have extraordinary powers in producing special effects when added to steel, even in small quantity. These powers might be considered only as of passing interest from the point of view of the chemist, were they not practically confined to one group of metals, and possessed more or less by each member of that group. It is true that valuable properties are imparted by other metals, such as aluminium, manganese, nickel, and chromium; but their effects are less marked, and are produced by the addition of a comparatively large quantity of the metal, excepting in the case of aluminium, whose action is, however, of an entirely different nature.

The recent demand for these rare metals has resulted in a large increase in the production of the minerals containing them. They were commonly passed over by the prospector or ignored by the analyst; and the present increased supply is mainly due to increased education, and is much on a par with the production of monazite and other thorium-containing minerals used for incandescent gas-mantles, and now obtainable from alluvial and other deposits in many parts of the world, in addition to its early and only source in Brazil. Upwards of 200 million of such mantles are now produced annually. The best concentrated monazite sand averages only about 5 per cent. of thoria and other earths actually required by the mantle industry, so that a large field is open for research to utilize the ceria, zirconia, didymia, &c., which are obtained as bye-products.

For the post of Assistant Water-Works Engineer, 87 applications have been received by the Water Committee of the Bolton Corporation. The commencing salary is £250 per annum, rising by £25 a year to £300.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

A Monthly Meeting of the Scottish Junior Gas Association (Western District) was held in Glasgow on Saturday evening—Mr. D. Currie, of Stirling, the President, in the chair. There was only a small attendance.

The President having opened the proceedings,

CHEMISTRY OF COAL GAS AND BYE-PRODUCT MANUFACTURE.

Mr. D. T. Marwick (Dawsholm) read a paper on this subject, in the course of which he said:

Coal is composed of the elements carbon, hydrogen, oxygen, nitrogen, and sulphur, with ash or earthy matter as impurity. From an analysis of coal, the exact amount of each element present is easily obtained; but no idea is gained as to the combinations of such therein. A very important point gained by the analysis of coal is the ascertaining of the amount of unoxidized hydrogen. As you are well aware, 16 parts of oxygen and 2 parts of hydrogen unite to form water; so that only the hydrogen remaining after combining with the oxygen in the coal is available for the formation of hydrocarbon compounds. For gas-making purposes, a coal should contain at least 4 per cent. of unoxidized hydrogen. Scotch coals, as a rule, contain more than English coals; and this gives us a decided advantage in gas making here. In Scotland, a mixture of the most ordinary coals carbonized and the resultant gas purified by iron oxide, will give 16-candle gas when tested with the "Metropolitan" burner No. 2.

In Dawsholm we have heats of 1900° Fahr. on an average, with heavy charges in horizontal retorts and carbonized for four hours. We find on taking any one coal and distilling at temperatures (say) from 1400° to 1800° Fahr., as the temperature increases so does the yield of gas, while, on the other hand, the illuminating power decreases. Candle power now-a-days being a secondary consideration, this is a strong argument in favour of high heats. We will suppose our coal is in the retort at a temperature of 1800° Fahr. and the carbonization started. The temperature will run about 1400° Fahr. near the walls of the retort, and in the centre of the coal it may be only about 700° Fahr. While again the gas near the coal is at a temperature of 1100° Fahr., that coming into contact with the sides of the retorts is exposed to one of 1800° Fahr. The coal in contact with the retort is immediately decomposed, and hydrocarbons of the olefine series are evolved. These mostly break down to ethylene, which, in turn, decomposes almost entirely, giving methane, hydrogen, and carbon, thus—

$$2C_2H_4 = 3C + CH_4 + 4H.$$

In the interior mass of coal, where heat is more moderate, we get passing off with the gas heavy hydrocarbon vapours, which, being liquid at ordinary temperatures, condense on leaving the retort, forming tar. Some of these vapours, getting into contact with the heated sides of a retort, deposit carbon, and give ethylene, which decomposes as shown above.

As the heat penetrates through the mass of coal, the whole of the hydrocarbons evolved are immediately decomposed, and free hydrogen is almost the only product. Then the paraffin hydrocarbons which are present in the coal during carbonization are split up into simpler members, and also form members of the olefine series. On contact with the walls of the retort, they give a series of complex reactions. Thus, taking ethane, which is the second lowest member of the group, we find that it forms ethylene and hydrogen—

$$C_2H_6 = C_2H_4 + H_2.$$

The ethylene also forms methane and small quantities of acetylene—

$$4C_2H_4 = 2CH_4 + 3\,C_2H_2 + 2H.$$

Then when the heats are high acetylene readily polymerizes, giving benzene and other members of that series—

$$3C_2H_2 = C_6H_6.$$

A portion of the benzene tends to condense, losing hydrogen, and forming naphthalene—

$$5C_6H_6 = 3H_2 + 3C_{10}H_8.$$

The hydrogen in the coal passes off with oxygen as aqueous vapour, and the remainder with the hydrocarbon compounds mentioned, and any excess in the free state.

Sulphur is evolved principally as sulphuretted hydrogen (H_2S) and some bisulphide of carbon (CS_2) and other compounds in small quantities. When coals are damp, the sulphur compounds are always higher; the aqueous vapour and sulphur readily forming sulphuretted hydrogen. High heats always produce increased yield of sulphuretted hydrogen and more especially bisulphide of carbon, which latter compound may be increased by one-third. The carbon and sulphur at high temperatures readily combine to form bisulphide of carbon.

The aqueous vapour in coal with carbon forms carbon monoxide (CO), carbonic acid gas (CO_2), and hydrogen. Wet coals give an increased amount of carbonic acid gas—

$$3H_2O + C_2 = CO + CO_2 + 6H.$$

Nitrogen on carbonization gives generally 15 per cent. as ammonia, 1·5 per cent. as cyanogen, 35 per cent. in gas and tar, and the remainder (48·5 per cent.) in coke. High heats give an increased yield of ammonia; while very high temperatures greatly increase the yield of cyanogen, at the expense of the ammonia. The

quality and quantity of the tar produced is greatly dependent on the temperatures employed. The higher the temperatures are, so the volume decreases; but the specific gravity, due to the presence of free carbon, increases (1·1 to 1·2). Pitch may increase from 30 per cent. at low heats to 60 per cent. at high heats. The naphtha, creosote, and anthracene in tar falls considerably; while the percentage of light oils disappears almost entirely. The phenols in tar are due to the splitting-up of oxygen compounds in the coal; and they increase with the percentage of that element. The composition of tars varies considerably from different coals. The coke produced, I need hardly add, contains hydrogen, oxygen, nitrogen, and sulphur, and ash as well as carbon. The harder the coke, the higher the percentage of carbon.

Regarding the temperature for carbonization, I favour heats of (say) 1800° Fahr., with heavy charges; and the gas produced will be 16-candle, and the bye-products will show a considerable revenue when worked up. If gas manufacture were carefully conducted, each coal should be tested at various heats, and the exact amount of the gas and bye-products noted, and the value of each. From such data the temperature used and the coals employed in the works would be found. I give an analysis of Dawsholm gas as it leaves the hydraulic main:—

	Per Cent.
Sulphuretted hydrogen and bisulphide of carbon	2·0
Carbonic acid gas	3·6
Ammonia	1·0
Cyanogen	0·2
Olefines	4·0
Benzine	0·5
Oxygen	0·2
Carbon monoxide	9·5
Methane	31·5
Hydrogen	45·0
Nitrogen	2·5
	100·0

The ammonia remaining in the gas after passing the condenser is removed in the scrubbers. Being an alkaline base that combines with sulphuretted hydrogen and carbon dioxide, both being acids, and salts are formed in the liquors—

A. $\begin{cases} 2\,NH_3 + H_2S = (NH_4)_2S \\ 2\,NH_3 + CO_2 + H_2O = (NH_4)_2\,CO_3 \end{cases}$

B. $\begin{cases} NH_3 + H_2S = NH_4\,HS \\ NH_3 + CO_2 + H_2O = NH_4\,HCO_3 \end{cases}$

A. Neutral salts. B. Acid salts.

Our aim is to obtain the formation of the second series of salts, and so remove from the gas as much sulphuretted hydrogen and carbonic acid as possible. This cannot be carried out in practice, as neutral salts are always also produced; and carbon dioxide has a greater affinity for ammonia than sulphuretted hydrogen. In fact, 100 volumes of ammonia combine only with 50 volumes of carbonic acid and 12·5 volumes of sulphuretted hydrogen. Ammoniacal liquor, being a solution of ammonia, readily gives off ammonia at increased temperatures or in strong solution; so the temperature of the gas and the specific gravity of the liquors are carefully noted. Had we 8 per cent. instead of 1 per cent. of ammonia in gas, we could expect to remove practically all the carbonic acid and sulphuretted hydrogen from it in the ammonia scrubbers. It has been proposed to oxidize sulphuretted hydrogen to sulphur dioxide; and this with ammonia gives ammonium sulphite, which is further oxidized to ammonium sulphate. There is no doubt that the foregoing are the right lines upon which to work. We have ammonia and sulphur in our coal gas, so why have the expense of buying sulphuric acid for the manufacture of ammonium sulphate, and then recovering the sulphur evolved as sulphuretted hydrogen from the sulphate-stills? I think that the above will be the future method of manufacturing ammonium ulphate, and the necessity for sulphur purifiers will be avoided, as the carbonic acid may be left in the gas.

Cyanogen should be removed before the gas is passed into the ammonia scrubbers; otherwise a considerable portion of it is lost. At Dawsholm, the Foulis process is used; and in it the gas must be free from ammonia. The gas passes into round scrubbers containing a mixture of ferrous and sodium carbonate, when sodium ferrocyanide is formed, and any oxygen present forms insoluble prussian blue. After being worked up in the scrubbers, the liquors are evaporated, and the product contains 30 per cent. of sodium ferrocyanide and 10 per cent. of water. This product is treated with caustic soda, and the insoluble prussian blue is converted into soluble ferrocyanide. From this potassium cyanide is prepared, and used for the extraction of gold from low-grade ores of the Transvaal. The cyanogen is produced by ammonia reacting with hot coke in the retorts. Ammonia passing into the cyanide scrubbers forms ammonium sulphocyanide, which is not recovered by this process.

Carbon dioxide lowers the illuminating power of the gas. But now-a-days, with low candle power standards, this is a matter of small importance; so lime as a purifying agent is unnecessary. Sulphuretted hydrogen must be removed from the gas, and iron oxide is the material generally used. It has no effect on carbon dioxide; but cyanogen passing forward forms iron ferrocyanide, and cyanogen can be extracted from this compound. Lime purification is used when carbonic acid gas has to be removed. It is also employed when bisulphide of carbon and any other sulphur compounds have to be kept down to a very low figure. As a means of removing sulphuretted hydrogen it is most expensive, as the waste lime commands no price worth speaking of. Carbon bisulphide is removed to a small extent by the lime purifiers; but if air has been drawn in, it will be almost completely removed. The drawing in of air in lime purification results in twice as much sulphuretted hydrogen being taken out as if none were used. The various sulphur compounds formed seem to be oxidized by the air, giving thiosulphate and free sulphur, which latter shows the largest increase. I consider it is a most expensive and ridiculous method of sulphur purification to draw in air to lime purifiers. You use lime to remove the effect of the carbonic acid in coal gas, and then draw in air, which also is a diluent.

The ammoniacal liquors from the condensers, scrubbers, and hydraulic main, are collected and distilled in special stills by means of steam; lime being added to liberate the fixed ammonia. This is absorbed by sulphuric acid, and crystals of ammonium sulphate are formed. The waste gases from the still consist of carbonic acid and sulphuretted hydrogen; and they are either absorbed by oxide of iron or burnt in a Claus kiln and sulphur obtained. The yield of sulphate per ton of coal varies; but 28 lbs. of $(NH_4)_2\,SO_4$ may be considered very satisfactory.

Coal tar is distilled in wrought-iron stills, and the vapour passing off condenses in iron worms immersed in water. A thermometer in the stills will give the temperature, and show when the receiver should be changed. The method of procedure naturally varies in different works with regard to the temperatures when the receiver is changed and the number of fractions taken. I give you an analysis of tar, showing the amount by weight of products, from the Dawsholm Chemical Works.

Ammoniacal liquor	2·0
Crude naphtha	2·0
Creosote	30·0
Pitch	66·0
	100·0

The products that are obtained from coal tar are: Pitch, used for asphalt and varnish. Benzine, prepared from 90 per cent. benzol. Nitrobenzene, formed from benzine. This compound is often used instead of oil of bitter almonds for perfuming purposes, but chiefly for the manufacture of aniline, from which aniline dyes are produced. Phenol (pure carbolic acid). By the action of sulphuric and nitric acids, picric acid is formed. This substance is an explosive, and as lyddite in South Africa and melenite at Port Arthur is all too well known. It is of great value for dyeing silk and wool a brilliant yellow. Naphthalene, used for the manufacture of various dyes. Naphthol, which gives us naphthalene yellow. Anthracene, which is the starting-point for the manufacture of alizarine colouring matter used in producing turkey red dye. This alizarine is a substance which has been used for dyeing since the earliest time, and was always prepared from roots until the discovery of the above process. Triphenylmethane, which can be prepared from benzine. From it we obtain various compounds used as dyes.

Discussion.

Mr. P. M'Dougall (Helensburgh) said it would be out of the question to attempt to travel over in detail extemporaneously the very important points contained in the paper. This must be left till they had it in the Technical Press. However, viewing the gas industry on broad lines, it resolved itself into a system of partial conservation and distribution of energy, governed by important chemical and physical laws. It was interesting to note that chemical reactions could be of two kinds—viz., exothermic and endothermic. During exothermic reaction, heat was liberated, as indicated by $C + O_2$; and when endothermic reaction was taking place, heat was absorbed, as indicated by $C + H_2O = H\,CO_2$. It was equally important to note that the difference in energy between two identical conditions of a system must be the same, irrespective of the method by which the system was transferred from one condition to another. To put it in a different way, the complete combustion of carbon with oxygen was carried out with the liberation of 14,500 B.Th.U., whether combustion went on in one or two phases. In one phase they had $C + O_2 = CO_2 +$ 14,500 B.Th.U.; and in two phases they had (1) $C + O = CO +$ 4000 B.Th.U. and (2) $CO + O = CO_2 +$ 10,500 B.Th.U. The total heat generated was equivalent to that evolved by the first. By the term "combustion," when speaking of producers, they meant the interaction between carbon and oxygen in the development of sensible heat. It was interesting to note that this interaction could take place in two forms—thus: (1) $C + O_2 = CO_2 +$ 14,500 B.Th.U. for 1 lb. of carbon; (2) $2C + O_2 = 2CO +$ 8000 B.Th.U. for 2 lbs. of carbon; and (3) $2CO + O_2 = 2CO_2 +$ 21,000 B.Th.U. for 3 lbs. of carbon. Each of these was a true combustion in the sense that both were accompanied by the production of sensible heat. In order to work retorts properly, it was essential that the last two reactions should take place distinctly, and be realized in different parts of the setting.

Mr. F. Cuthbert (Kirkintilloch) pointed out that the author told them that unoxidized hydrogen in Scotch coal was 4 per cent., while in English coal it was less; and he asked if Mr. Marwick could give them the figure for English coal. He also spoke of the introduction of 1 per cent. of oxygen. What would he recommend if oxygen were not available?

Mr. J. Fraser (Provan) said he could corroborate what Mr. Marwick had stated about high heats. They had had experience with them, and could prove conclusively that they increased the value and improved the illuminating power of the gas. So much was this the case, that at Provan they were in a position to reduce

their gas to the standard; whereas he understood that at some smaller works it was very difficult to bring it down to anything approaching this.

Mr. A. KELLOCK (Alloa) agreed with the previous speaker that the higher the heats the better the results. Two or three years ago, at Alloa, they started with heavier charges and higher heats; and the results had shown that they were on the right lines. But there was always one thing they had to say, which the previous speaker had forgotten to mention—that the naphthalene trouble started with them. This was a thing not heard of in Scotland some years ago. With them, it came with the high heats and the high gas yields; and they had to look elsewhere in order to find some means of getting rid of the naphthalene. They had tried an Everitt's tar extractor, and now they were not so much troubled with naphthalene. In the matter of purification, they could not be too careful of the way they looked after their scrubbers. In Alloa they had saved their purifiers considerably by doing so. The author did not say much in regard to the quantity of air used to revivify oxide *in situ*. They had done a good deal of this of late. They could put in 3 per cent. of air; and they had been able to pass through one purifier, before they required to turn out the contents, as much as 120 million cubic feet of gas, which was nearly equal to a year's production.

Mr. FRASER wished to mention that he had overlooked the matter of naphthalene; but the same thing applied to all gas-works where high heats were in use. It applied to Provan; but with a little care it could be avoided. They made it a point to clean the scrubbers thoroughly in summer, and so saved the purifiers as much as possible during the winter.

Mr. T. W. SAVILLE (Thornliebank) asked for more information about the working of coal tar and the proportion of pitch.

Mr. D. FULTON (Dawsholm) remarked that Mr. Marwick probably had done full justice to his subject, and had touched on matters which were new to the Association. A paper like his gave information which the members generally could only acquire by reading up text-books; and therefore they were the more indebted to him.

The PRESIDENT considered that Mr. Marwick had, in his paper, conveyed to the members a lesson as to how gas should be manufactured—viz., that the gas maker ought to know exactly what was taking place in every process, from the time he received the coal into the works until he had sold the bye-product. The scope of the paper had been so great that they could not devote the time to go into any detail of the methods employed in the carrying out of tests or the methods of operation in the works with which he was connected. But in bringing the various operations before them, the author had directed their attention to what ought to be the method adopted in manufacturing gas. Several speakers had dealt with the question of high *versus* low heats. The subject was one upon which there was great diversity of opinion, even at the present time. Previous speakers had, however, omitted to mention what they meant by heavy charges. What might be a heavy charge to one man might be a medium charge to another; so that they could not make any comparison from results, so far as naphthalene was concerned. His own observation with regard to heavy charges was that what they might call high heat—that was to say, simply roasting the coal—he did not believe in at all. He believed in having a heat just sufficient to burn off the charge in a given time, with no excessive heat. Of course, with hand stoking heavy charging could not be adopted on the same scale as with machinery. With this they could charge a retort up to 3 inches of the crown. They could get in about 12 cwt., and could lay it level. If the charge were uneven, or if the heats were too high, they would begin to find naphthalene. Again, if the retorts were charged low towards the mouthpiece, they would be troubled with choked ascension-pipes; but if charged full up, the same as in the centre, there would be no trouble. These were matters which cropped up periodically through the conditions of extra high heats with uneven charges. He asked the members to accord Mr. Marwick a hearty vote of thanks for his most interesting and instructive paper.

This having been cordially agreed to,

Mr. MARWICK thanked the members for their reception of his paper. He was asked about unoxidized hydrogen in English coal. What he said was that English coal might be about 4 per cent., and that Scotch coal might be 4½ or 5 per cent. As to oxygen, he said that for 1 per cent. of sulphur they drew in 3 per cent. of air. Where they had naphthalene, the principal trouble was cooled water. He would not consider 1800° Fahr. to be a high heat. Some authorities said that the best temperature for carbonization was when the free compounds were broken down, and benzene was formed, but that they should not go so far that the benzene would form naphtha. The other was, they should strike the heat where they had a small proportion of benzene formed. He did not believe in very high heats, and taking everything out of the coal. What the President said about heavy charges was very interesting. He approved of having the retorts well filled up, because it gave less surface, and the gas was not so exposed to heat all over; moreover, naphthalene was not formed. One speaker mentioned that he might have given some particulars about coal tar; but he had not gone into any details.

MR. FLETCHER'S PAPER ON INCANDESCENT GAS LIGHTING.

The PRESIDENT reminded the meeting that the discussion upon the paper by Mr. Laurence Fletcher, the Chief Engineer to the Welsbach Incandescent Gaslight Company, Limited, on "Incandescent Gas Lighting—Some Points of Interest," which was read at the January meeting of the Association [see *ante*, p. 105], had been postponed to that evening. He said the paper was a very interesting one, and the members had had the opportunity of studying it in the Technical Press. It was certainly worth studying, because the members would gain a good deal of knowledge from it—Mr. Fletcher being an expert authority on the subject. One thing which must have attracted their attention was his description of the quality of gas best suited for incandescent gas lighting. He advocated gas of from 12 to 14 candle power, with a minimum pressure of 2 inches at the burner. This statement, coming from an authority such as Mr. Fletcher was, must make them think of the quality of their own gas. Very few gas undertakings in Scotland supplied gas of less than 20-candle power; so that, in order to get the best results from incandescent gas lighting, they would have to make a big stride in the direction of reducing the illuminating power. It was very interesting to hear of the importance of having a properly fitting mantle.

No other remarks being offered,

The PRESIDENT asked the members to accord a hearty vote of thanks to Mr. Fletcher for his paper.

This was heartily given; and the proceedings closed.

Beckton Rifle Club.

On Saturday evening, the annual prize-giving and dinner of this club was held at Beckton in a room adjacent to the Rifle Ranges. The "G" company of "The Rangers" (the 12th Battalion County of London Regiment) dined with the Rifle Club. The room was beautifully decorated. The chair was taken by Mr. Corbet Woodall, who is President of the Rifle Club, and Hon. Colonel of the Rangers. The Gaslight and Coke Company have furnished the club with admirable covered and open ranges of 25, 50, and 100 yards respectively. Of the Rangers, three companies, or more than 300 men, are recruited from the stations of the Company, and seven of the officers are in the same employ. The Rifle Club has some 400 members; and the standard of shooting, as evidenced by the year's record of competitions, is very good indeed. Mr. J. N. Reeson, the Engineer of the Beckton station, has taken great interest in the Club, and is himself an excellent marksman. The proceedings on Saturday evening were characterized by much enthusiasm, and evidenced the good relations existing between all ranks in the service. After dinner the toast of "The King" was honoured. Then followed "The Navy, Army, and Reserve Forces," proposed by the Chairman, and responded to by Colonel H. S. Coldicott, V.D. The distribution of prizes by Mr. Woodall succeeded. In his usual happy vein, Mr. D. Milne Watson, the General Manager of the Gaslight Company, proposed a hearty vote of thanks to the President; and needless to say there was enthusiastic reception and compliance. Mr. H. Marks, the Editor of the "Marksman," submitted the toast of "The Gaslight and Coke Company," and response was made by Mr. J. Douglas Walker, K.C., one of the members of the Board. An excellent programme of music was rendered during the evening. The enjoyment of the occasion will further increase the pleasurable anticipation of the next annual dinner and prize-giving.

Notes from Hythe.—In the paper which he read before the London and Southern District Junior Gas Association last Friday week, entitled "Notes from Hythe," Mr. C. E. Rosevear stated that "for the year ended June 30, 1909, the leakage amounted to about 21 per cent.; while for the six months to Dec. 31, it was only about 6 per cent." He has since discovered that this calculation was based on a wrong figure as to output, and that the leakage for the past half year was in reality 18 per cent., and not 6 per cent.

Analyses of Municipal Gas Accounts.—We have received from Messrs. John Allan and Co. the "Gas World Analyses of Municipal Gas Accounts" for 1908-9. The accounts of 69 municipal gas authorities are analyzed; all the items of revenue and expenditure being worked out at per 1000 cubic feet of gas sold. The makes of gas of the undertakings range from 45 million to upwards of 7000 million cubic feet per annum. Comparisons can be made of the make and sale of gas per ton of coal, of the residuals produced, of the capital charges, and of the capital employed in proportion to the volume of business done, &c. Cardboard rules, either in blank to allow of figures being filled in, or with the figures of any particular undertaking in the series printed thereon, are supplied with the "Analyses," so as to facilitate the comparison of one account with another. The price of the book is 10s. 6d. net.

Presentations to Mr. J. W. Schofield, of Huddersfield.—Last Friday week, as many of the chief officers of Huddersfield Corporation as could attend assembled in one of the committee-rooms at the Town Hall to make a presentation to Mr. J. W. Schofield, the Water-Works Manager, on the occasion of his forthcoming marriage. The article presented was a handsome oak writing-table, to which was affixed a brass plate bearing the following inscription: "To J. W. Schofield, Esq., by his brother chief officers, Huddersfield Corporation, with sincere regard and best wishes on the occasion of his marriage, 31st January, 1910." The Mayor (Alderman John Holroyd) presided, and made the presentation. He said he had the greatest pleasure in asking Mr. Schofield's acceptance of the handsome piece of furniture which had been selected, hoping that he and his wife might live many years to use the table.

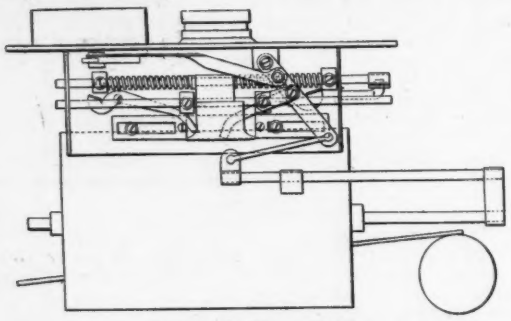
REGISTER OF PATENTS.

Liquid Meters.

DONISTHORPE, E. S.; a communication from W. BERESFORD, of Bristol, R.I., U.S.A.

No. 1143; Jan. 16, 1909.

This invention relates to liquid meters of the class in which the reciprocating movement of a piston in a measuring cylinder actuates the valve by which the liquid to be measured is directed to either end of the cylinder alternately.



Beresford's Water-Meter.

The liquid, on its way to the cylinder, passes through a valve chamber in the form of a cylinder open at both ends and having near each end a port leading to a measuring cylinder—the inlet port being at the middle of its length. In this chamber is a valve consisting of two pistons connected together, but at such a distance apart that when one is at one end of the chamber (which is thus closed) the other lies between the inlet port and the outlet port at the other end. The valve is preferably operated as follows: A rod parallel with the piston-rod, and sliding backwards and forwards by its motion, has upon it a pair of lugs actuating a sliding block loose upon the valve-rod, which carries two helical springs, the outer ends of which are secured to adjustable stops on the valve-rod while the inner ends are loose and butt against the sliding block. A pair of pivoted catches is adapted to engage the stops, at either extreme position of the valve-rod; and the catches are tripped by a slide near the end of the travel of the piston. Preferably the rod first mentioned is slid backwards and forwards by a link connecting it to an arm suspended from a pivot about which it is rocked by the reciprocating movement of another rod directly connected to the piston-rod. The lugs and stops may both be adjustable on their rods so that the amount of liquid passing on each stroke can be adjusted.

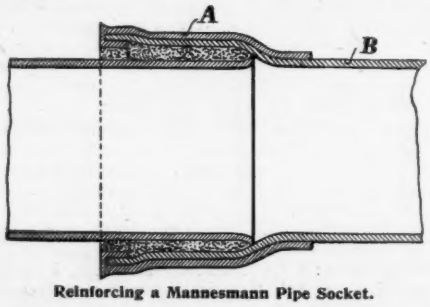
The action is as follows: Supposing the piston and valve to be at the left of their travel, the left stop being engaged by its catch. The left end of the valve chamber is closed; and liquid entering it passes through the left port to the left end of the cylinder—moving the piston to the right. The liquid in the cylinder will thus be expelled through the right port and away through the right end of the chamber. The movement of the piston causes the block to move to the right, compressing the right-hand spring and allowing the left-hand spring to extend. As the piston nears the end of its travel to the right, the left catch is tripped, releasing the valve-rod, which is thrown over to the right by the right-hand spring—thus giving a sudden movement to the valves. The valve-rod is then caught by the right-hand catch, and corresponding movements in the reverse direction ensue.

Pipes with Reinforced Sockets.

ISENBURG, L., of Bous-on-the-Saar, Germany, KÜHN, P., of Landore, South Wales, and the BRITISH MANNESMANN TUBE COMPANY, LIMITED, of Salisbury House, E.C.

No. 1601; Jan. 22, 1909.

According to this invention, the reinforcing sleeve placed over the socket end of the pipe is held fast on the socket end by beading the end of the sleeve over the end of the socket, which latter end is preferably flattened out.



Reinforcing a Mannesmann Pipe Socket.

As shown, one portion of the reinforcing ring or sleeve A is mounted in the usual way on the end of the pipe B. The end of the ring projecting over the top end of the pipe is beaded over on the inside of the pipe, so that it fits against the inside of the pipe—this tight fitting being brought about and assisted by pressing. The beaded end of the ring is preferably flattened out, and the top end is provided with sharp edges similar to the old socket pipe ends provided with thickened ends.

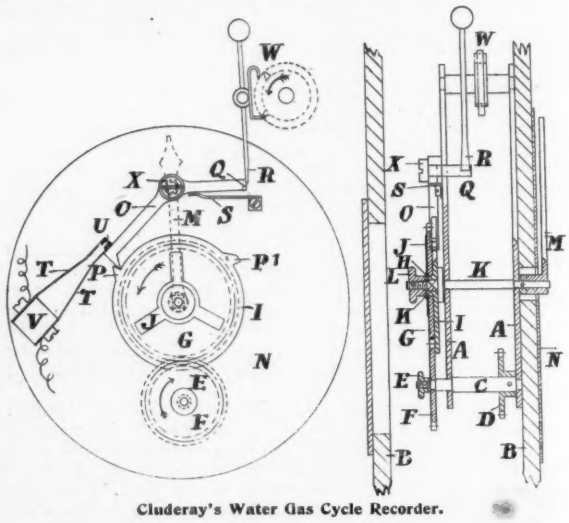
The projection formed by the reinforcing ring in the interior of the pipe socket prevents the packing leaving its place; and, moreover, the projection resists a pulling apart of the pipes. This resistance can be increased by bending the end of a pipe adapted to fit into the socket a little in the upper or outward direction, so that it will engage behind or in the packing.

Indicating the Expiration of Certain Intervals in the Manufacture of Water Gas.

CLUDERAY, E. S., of Harrogate.

No. 1835; Jan. 26, 1909.

This invention has for its object the timing of certain operations occurring in the manufacture of water gas and the like.



Cluderay's Water Gas Cycle Recorder.

The apparatus (shown in back and side elevation) is carried by plates A, enclosed in a case B. The arbor C is driven by clock-movement through the spur-wheel D, in the usual manner, and carries, held in position by the knurled nut E, an interchangeable spur-wheel F, which gears with a spur-wheel G, held on the round bush H, integral with the tappet-wheel I, by the spring J. The tappet-wheel has a square hole in the centre, and is held on to a squared arbor K, by a left-handed knurled nut L. The arbor carries at its other extremity a pointer M, moving round a dial N. A lever O, pivoted on the screw X, is moved at certain intervals by the tappet-wheel teeth P, so depressing the detent Q, and releasing the alarm W, by means of the hammer tail R. The lever O is kept in contact with the tappet-wheel I by the spring S. The friction spring J allows the pointer, arbor, and tappet-wheel to be revolved independently of the wheel G. To change the time of revolution of the pointer, and the ringing of the alarm, it is only necessary to unscrew the nuts E L and replace the spur-wheel F and the tappet-wheel, spring, and spur-wheel I J G with others having the required ratios. The lever O is also arranged to close an electric bell circuit by means of the springs T, having platinum contacts U, carried on the insulating block V.

In order to better understand the use of his invention, it is explained that in the manufacture of water gas the operator must open or close certain valves at definite intervals while the plant is in operation—say, open alternately a blast-valve for three minutes and a steam-valve for six minutes, and to repeat this cycle as often as is necessary. The object of the invention is to show more distinctly and more accurately, by the pointer and dial, the interval of time which has elapsed since the valve was opened, and also, by the ringing of an alarm, to indicate accurately to the operator that one valve must be closed and others opened. To accomplish this, the arbor carrying the pointer and tappet-wheel is caused to make a revolution in the time of a cycle of operations (say, nine minutes); the tappet-wheel teeth being at such positions as will correspond with these times.

The apparatus is used as follows: The clock being stopped by a lever (not shown), immediately after opening the blast-valve the lever is moved, starting the clock, which causes the arbor, tappet-wheel, and pointer to revolve by means of the spur-wheels. When the required interval has elapsed, the tooth P^1 comes into contact with the lever O, and releases the alarm for a few seconds until the lever O drops off the tooth. The alarm is now silent until the tooth P comes into action, causing a second ringing of the alarm, which may be longer or shorter than the first, according to the width of the tooth. The pointer will now have returned to zero, and the cycle may be repeated as necessary.

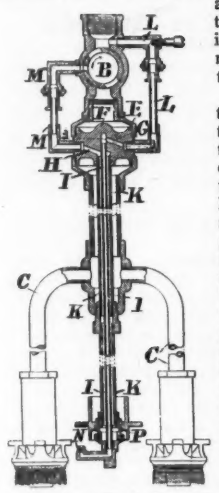
Gas-Lamps.

BREEDEN AND CO., LIMITED, of Birmingham.

No. 5972; March 12, 1909.

The patentees arrange below the main supply or down pipe of the lamp an extension consisting of two concentric tubes the inner or axial tube extending through the bottom or closed end of a "flash-light" body part with which the outer or larger tube terminates. The bent-up projecting part of the inner or axial tube is provided with a pilot-burner adjacent to the "flash-light" body part, which latter has in its cylindrical portion a series of perforations, and over the perforated part is a cap or depending shield having in it a series of notches. The

inner tube (to which a permanent supply of gas is maintained by the ordinary bye-pass supply pipe to which it is connected) provides a constant flame to the pilot burner; while the outer tube is attached to a supplementary bye-pass pipe connected to the barrel of the main supply tap, a passage in which tap opens temporarily to the supplementary bye-pass pipe as the main supply tap opens.



Breeden's "Flash-Light" Burner.

The main supply pipe of the lamp is controlled by the tap B; and in connection with the main pipe are two branch pipes terminating at their lower ends in inverted incandescent burners. At the junction of the tap with the main supply pipe is a short tubular body E, having a partition F crossing it diametrically and having gas-ways on each side and radial gas-ways G H within the wall of the partition. These gas-ways communicate with concentric inner tubes I K. The gas-way G is connected to the bye-pass gas-pipe L; while H is connected to a secondary bye-pass gas-pipe M, which is opened momentarily as the tap is turned from its fully-off to its fully-on position. The tap is represented partially turned on and the pipe M fully open. The lower end of the pipe I is connected to the pilot-burner N; while the pipe H is connected to the "flash-light" body P, having the series of jets surrounded by a cap S having in it a series of notches.

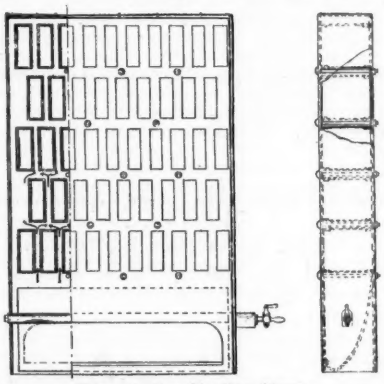
When a supply of gas issues from the perforations in P the pilot-light N causes the series of jets in it to ignite the gas issuing from the burners D; and as the main supply tap is fully opened, the supply to the supplementary or secondary bye-pass pipe M is cut off.

Gas-Stoves.

BERGER, M., of Zurich, Switzerland.

No. 13,940; June 14, 1909. Date claimed under International Convention, Aug. 3, 1908.

To "secure more efficient utilization of the heat of gases burnt in gas-stoves," the patentee proposes to arrange, above the gas-burner pipe, channels (of rectangular cross section) in rows in the heating body; the channels in each row being staggered relatively to those in the rows above and below. The channels, which traverse the heating body, are


Berger's Gas-Heating Stove.

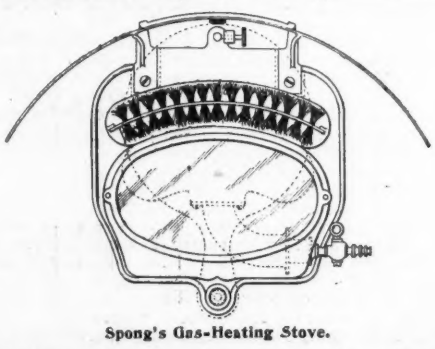
open at both ends—an arrangement that compels the heating gases to traverse a long path from the bottom to the top, and "by this means efficient utilization of the heat is obtained." The cooled gases leave through openings at the top; and the waste gases are preferably led away to a chimney.

Gas-Heating Stoves.

SPONG, J. O., of High Holborn, London.

No. 14,157; June 16, 1909.

This invention relates to the class of gas-stove used for heating described in patent No. 23,610 of 1908. The proposal is to take a sheet of mica of the desired size and perforate it in any desired manner In


Spong's Gas-Heating Stove.

the perforations are placed bunches of asbestos fibre or thread in such a manner that the bunches project from both sides of the mica sheet, which is placed in a vertical position between two rows of gas-burners, the flames from which lick up between the asbestos fibre and render it incandescent, "conveying great heat which, with the aid of a reflector behind, becomes thrown or diffused into the room and at a great distance away from the burners."

Settings of Vertical Retorts.

WOODALL, H. W., of Bournemouth, and DUCKHAM, A. M'D., of Little Bookham, Surrey.

No. 21,554; Sept. 21, 1909.

In constructing the settings of vertical retorts, the patentees point out that "it is difficult to provide for the adequate support of the retort without obstructing the interspaces which constitute the flues and leaving exposed too small an area of retort."

According to the present invention, the thickness of the supporting columns of the setting may be considerably reduced by forming the openings therein, through which the combustion gases pass, of lanceolated shape. Owing to this construction, the columns may be comparatively thin—thus allowing the maximum cross section for the flues and covering as little as possible of the retort surface.

They add: Vertical retorts are generally of elliptical section, and require better support on the long sides than on the short sides. To secure this without unduly covering the surface, the columns supporting the long sides are, according to this invention, built in such a manner that at frequent, and preferably regular, intervals there is inserted a brick having wings which extend over a greater surface of the retort than that covered by a brick without wings.

Fig. 1.

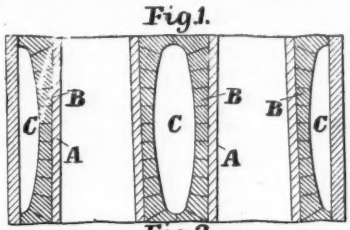


Fig. 3.

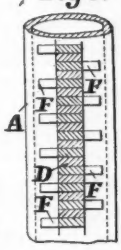
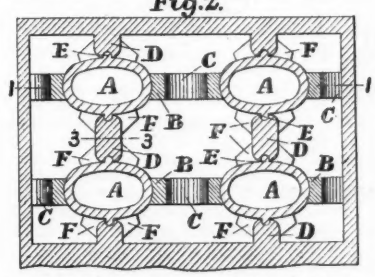


Fig. 2.



Woodall and Duckham's Vertical-Retort Settings.

The invention is illustrated as applied to a setting of four retorts—fig. 1 being a vertical section on the line 1 of fig. 2 (a horizontal section); while fig. 3 is a part section on the line 3.

The narrow sides of the retorts A are supported by walls or columns B, in which, at a suitable distance from each other, are openings C, of lanceolated shape, for the passage of the combustion gases. The columns D, which engage ribs E on the retort (as described in patent No. 24,695 of 1906), are built of bricks, of which each alternate one has a wing F; the wings extending alternately to the right and to the left of the column.

APPLICATIONS FOR LETTERS PATENT.

1722.—VIVIAN, F. G., "Asbestos top-rimmed incandescent burner." Jan. 24.

1724.—ROSE, A., and BELLAMY, W., "Regulating the gas supply to burners." Jan. 24.

1869.—LUCAS, O. D., "Fluid-meters." Jan. 25.

1900.—GUTEHOFFNUNGSHUTTE AKTIENVEREIN FUR BERGBAN UND HUTTENBETRIEB, "Gas-producers." Jan. 25.

1909-10.—DEPREZ, O., and RICHIR, A., "Carburettors for illuminating or heating." Jan. 25.

1954.—COOPER, A., "Gas fire-lighter." Jan. 26.

2017.—WILLIAMS, G. A., "Gas-regulators." Jan. 26.

2046.—CUMMINS, F., "Regenerator furnace." Jan. 27.

2083.—AKT.-GES. VORM. H. MEINECKE, "Preventing unmeasured quantities of fluids from passing meters." Jan. 27.

2170.—SCHMITZ, W., "Inverted burner." Jan. 28.

2171.—SCHMITZ, W., "Mantle protector." Jan. 28.

2180.—BURNETT, J., "Liquid meters." Jan. 28.

2181.—LUCAS, P., "Incandescent gas-lighting." Jan. 28.

2220.—NEMEROVSKY, J. M. & F., "Burning machine for mantles." Jan. 28.

2222.—NEMEROVSKY, J. M. & F., "Machines for burning-off incandescent mantles." Jan. 28.

2223.—NEMEROVSKY, J. M. & F., "Looping and shaping mantles." Jan. 28.

2308.—PLATTS, H. C., "Packing for joints." Jan. 28.

In the "JOURNAL" for the 18th ult., p. 184, some particulars were given of a modified form of gas-main stopper, the invention of Mr. Patrick Goodman, of New York. We learn that Messrs. Parker and Lester, of Ormside Street, Old Kent Road, who have for many years past interested themselves in the introduction into English gas-works of Mr. Goodman's earlier arrangement of stopper, are handling the improvement covered by the 1909 patent.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

National Memorial to the late Sir George Livesey.

SIR,—"Now the hurly-burly's done, now the battle's lost and won," may I (politics apart) crave space to advocate a National Memorial to the late Sir George Livesey? However commendable the endowment of a Chair of Chemical and Physical Research in Leeds University may be, in my opinion it inadequately expresses what we feel for his loss, our admiration for his work, or his memory richly deserves.

To the man who made profit-sharing and co-partnership a living and practical force; produced an antidote to the moral, brutal, and social poison engendered by strikes, lock-outs, and kindred methods of settling labour disputes; forged and presented a weapon of peace to the manufacturing and other industries of the world—surely a National Monument is due, and should be provided; and I suggest that his statue in bronze be placed in the Embankment Gardens, in the Metropolis of the World, overlooking the Thames, upon whose waters are borne most of the raw material used in the metropolitan area in the production of artificial light, heat, and power.

A more appropriate position could not be imagined; and it would be an honour to the gas profession to carry it out.

But, Sir, bearing in mind the beneficial effects of co-partnership, and its extensive adoption and universal applicability, I appeal to a larger field of subscribers than the gas profession *per se* compose, and invite the co-operation of the vast industrial undertakings of the English-speaking race; and even those who speak a foreign tongue, if they desire to assist, should not be excluded from testifying their respect to the memory of our countryman, and to the lasting benefits that co-partnership and profit-sharing bring in their train. Its universal adoption would bring about "peace on earth and goodwill towards men"—"a consummation," Sir, "devoutly to be wished."

A commemorative statue of Isambard Brunel adorns the Embankment; and I hope to see our late leading gas engineer and administrator similarly honoured. Although not a man of means, my mite towards the necessary fund shall be forthcoming.

In conclusion, Sir, I ask for the use of your columns for correspondence, in order to bring this proposal to a successful issue.

C. E. JONES.

34, *Victoria Street, S.W., Feb.* 2, 1910.

Removing Scurf from Retorts.

SIR,—I see in your issue of yesterday (p. 300) a notice of a patent taken out in France by M. Rudolph Tenckhoff for a process for scurfing retorts. I have cleaned retorts in a similar way for more than twenty years. For some years I used a special malleable iron pipe ½-inch thick (after working on with thin ones for a long time); but even these would not stand more than a few cleanings. Some twelve or fifteen years ago, I tried ordinary 3-inch sanitary pipes just laid along the bottom of the retorts, with the spigot end pressed into the faucet, and pushed back to the end of the retort. The cap was then taken off the ascension-pipe, and the door closed up, with the pipe projecting for air supply. Since then we have not had one-fourth of the damage done to the retorts, as very often the carbon will clear off in a thin slice, without the use of a cleaning-bar, and with a very great saving of labour in cleaning. We sometimes use the same pipes for five or even six retorts. It is true we have not half the carbon for sale that we had before; but the loss of this seems to me only a secondary consideration compared with the saving of the retorts.

J. WHYTE.

Seaham Harbour, Feb. 2, 1910.

Chartered Institute of Secretaries.

SIR,—Referring to a paragraph in the "JOURNAL" of the 1st inst., I should like to say that the Council of the Chartered Institute of Secretaries has expressed its willingness to further the question of sectional meetings of its members. I am sure something might come of it, if gas secretaries who are members would write to the Secretary of the Institute at No. 65, London Wall, E.C., saying: (1) If they desire to meet or not; (2) the most suitable time of the year; (3) whether the meeting be confined to their own industry or open to others.

ANOTHER F.C.I.S.

Feb. 3, 1910.

Mr. Fletcher W. Stevenson on Coal Gas and Its Uses.

Considerable interest was evinced in a very instructive lecture delivered at the Coventry Municipal Technical Institute last Tuesday by Mr. Fletcher W. Stevenson, M.Inst.C.E., the Engineer and General Manager of the Corporation gas undertaking, who dealt with the history, manufacture, and uses of coal gas. The lecturer prefaced his remarks by referring briefly to the means employed for artificial illumination before the possibility of lighting by gas was discovered; the explanations being accompanied by an excellent series of lantern slides. Mr. Stevenson reviewed the history of coal gas, and gave a detailed description of the various processes connected with its production. Reference was made to the Welsbach mantle, and to the part it had played in the gas industry; and the lecturer gave some hints as to its use. The apparatus employed for testing the illuminating power of gas was described; and the utility of gas for cooking and heating purposes was dilated upon. The lecturer informed his hearers that there are in the United Kingdom at the present time more than 2 million gas-stoves in use; and he said that, thanks to their cleanliness and handiness, the number was rapidly extending. Progress was also being made in the use of gas-engines, of which there are now upwards of 120,000 at work. Mr. Stevenson gave statistics showing the growth of the gas industry in the last twenty years; and at the close of an entertaining lecture, for which he was cordially thanked, he answered a number of questions.

LEGAL INTELLIGENCE.

THE LAW AS TO THE GUARDING OF TRENCHES.

At the Edmonton County Court on Monday of last week, Walter Machin, a commercial traveller, of Forest Gate, brought an action against the Tottenham and Edmonton Gas Company to recover £50 as damages for personal injuries. Plaintiff met with an accident on Nov. 5, which he attributed to the negligence of the Company's servants in not protecting a trench made in the pavement, in order to lay on the gas to a shop in Lymington Avenue, Noel Park.

Mr. MEDCALF appeared for the plaintiff; and Mr. SCARLETT, for the Gas Company.

Plaintiff, giving evidence, stated that he was walking along at about 3 o'clock in the afternoon, when his foot caught against a paving-stone, and he was thrown across the trench, which he had not previously observed. There was a dense fog at the time; and he was short-sighted. He struck the side of his head against the pavement, and injured his left ear; and his leg was also bruised. When he picked himself up, he was in a dazed condition; and after someone had brushed his clothing, he proceeded home. On Nov. 9, he consulted Dr. Johnson, of Forest Gate; and from that date up to the present time, he had been under his treatment. For three weeks he was unable to follow his business, thus suffering a loss of £6 6s. in wages. He declared that the trench had been left unprotected.

In cross-examination, witness admitted he was blind in the left eye.

A witness who saw the plaintiff fall said that he did not notice any rods protecting the opening.

Mr. SCARLETT submitted that there was no case to answer, as the accident arose entirely owing to plaintiff's impaired eyesight.

Judge TINDAL ATKINSON, however, directed him to call evidence.

Two of the Company's servants, who were employed in making the connection to the premises, swore that the trench was protected by iron rods, which were fixed to an upright near the kerb, and stretched quite across the pavement. The point where they were attached was about 3 ft. 6 in. from the ground; and they sloped down till they were about 1 ft. 9 in. above the pavement near the shop front. It was denied that there was a thick fog at the time. The occupier of the shop gave similar evidence.

Mr. MEDCALF urged that the rods should have been fixed at the same level right across the pavement.

His HONOUR, in giving judgment, said that he was of opinion that the Company's servants did what was reasonable to protect ordinary persons from injury, and that the accident happened solely in consequence of the plaintiff's extremely defective vision. If it were held that it was obligatory on the Gas Company to so guard their trenches as to protect from accident all persons, whatever might be the condition of their eyesight, then the plaintiff would be entitled to judgment; but he did not think this was the law. He considered that the Company were only bound to take reasonable and proper precautions to protect those with ordinary eyesight; and he therefore gave judgment for the Company, with costs.

GAS MANAGER CHARGED WITH EMBEZZLEMENT.

At the Newport (Salop) Police Court, last Tuesday, James Wild, Working Manager of the Newport Gaslight and Coke Company, Limited was charged, before a Bench of Magistrates, with embezzling certain sums of money.

Mr. WATSON, in opening the case for the prosecution, said defendant was charged with embezzling on Oct. 11, 6s. 10d.; on Oct. 28, 2s. 6d.; on Dec. 3, 6s. 2d.; on Dec. 29, 2s. 1d.; and on Jan. 15, 10d. Part of his duty was to attend to the sale of coke and other products, and to enter these in a book, which book should contain a copy of the sales. It was also his duty to receive payments for these various sales, and at the end of each week to make a list of all the payments to the collector, who checked them, entering them in his books. Tickets for the sale of coke had been made out, giving the weight and the cash received; but in the duplicate copy both the weight and the amount were different. The discrepancies had not occurred because the defendant was not receiving sufficient remuneration, for he was in receipt of £2 per week, a house rent and rates free, together with coal and light. The discrepancies had been going on for twelve months.

Evidence was then given by persons that they had purchased and paid for coke on the dates named; and also by Mr. F. W. Hood, the Company's collector. The latter said, in cross-examination, that, in addition to managing the works, defendant had to connect services, read between 300 and 400 ordinary meters, and look after the prepayment meters.

Mr. ELLIOTT (for the accused) said defendant pleaded that he had received the moneys, but had not accounted for them. For nine years he had been a most faithful servant of the Company, who had recognized his services by giving him from time to time a bonus. During those years, hundreds of pounds had passed through his hands, and been duly accounted for. He was looked upon by everyone in Newport as an honest, straightforward, and hard-working man. From time to time he had to rely upon his memory, for only at the week-end did he notice that the figures in the duplicates were not clear. A man in defendant's position would not injure his character for such small sums. Having regard to the character borne by defendant previous to coming to Newport, and also his character during the nine years he had been there, the loss of his situation, and the trial and trouble he had brought, by being placed in his present position, upon his wife and children, he would ask them to deal with the case, having regard to the circumstances, under the Probationers' Offence Act.

The CHAIRMAN said the Bench would deal very leniently with the case. The defendant would be given the option of a fine of £10, including costs, or two months' hard labour.

THE GASLIGHT AND COKE COMPANY.

The One Hundred and Ninety-Sixth Half-Yearly Ordinary General Meeting of proprietors was held last Friday, at the Chief Office of the Company, Horseferry Road, Westminster—Mr. CORBET WOODALL (the Governor) in the chair.

The SECRETARY (Mr. H. Rayner) having read the notice convening the meeting, the seal of the Company was affixed to the Register of the Proprietors, and the report and accounts (which were given in the "JOURNAL" last week), were taken as read.

THE ACCOUNTS.

The GOVERNOR: It is now my duty to move that the report and statement of accounts be received and adopted. The report reminds you that the inclusion of the undertaking of the West Ham Company became an accomplished fact on Jan. 1 last. The accounts of the West Ham Company are published separately from ours for the past half year; and the dividend will also be paid independently. Henceforth, there will be no such distinction; and shareholders may for a time find more difficulty than at present in comparing the accounts of corresponding periods. We welcome any West Ham shareholders who may be present to-day. I have also to welcome a large body of co-partner proprietors who have acquired their holdings, and consequent right to be present, within the past half year. It is too early yet to say how far our hopes, founded on the adoption of this system, are being realized. The work of the half year has been excellent; and some share in the good results may fairly be attributed to the new relations which have been established. All ranks in the service are zealous and earnest. The number of co-partners is now 8700.

FAVOURABLE RESULTS.

I think you will agree with me that the results of the half-year's trading are creditable. You will remember that our charge for gas was less than in the corresponding period, and that the reduction represented a loss of revenue of more than £46,000. Yet, broadly stated, we have earned the full dividend of £4 13s. 4d. per cent., and have £67,000 to spare. Deducting from this the contribution of £10,000 to the redemption fund, and a similar sum added to the insurance fund, we are still able to increase the balance to the credit of profit and loss by £47,000. The details of the accounts deserve attention. Of capital, we have spent £76,000 almost entirely upon mains, meters, and stoves. Against this, we have credited £45,000 for renewals and depreciation; leaving the net increase on the expended capital for the half year £31,000.

THE CAPITAL ACCOUNT.

The story of the capital account is interesting. In 1903, Parliament gave us power to raise £750,000 in the form of 3 per cent. debenture stock. At that time, our unspent or floating balance was £845,000. Since then, the output of gas has increased by 2000 million cubic feet, and the floating balance has been reduced to £361,000; while we have issued no debentures. The capital spent in the seven years has thus been £484,000—equal to £240 per million cubic feet upon the additional gas sold. During the past four years, it has not averaged £110. In the year ended at Christmas, there was an increase of 600 million cubic feet in the quantity of gas sold; and the capital spent has been at the rate of less than £50 per million. The gross expenditure, which was £640 per million cubic feet sold in 1903, is now reduced to £596. If, in the future, we can maintain this rate of progress, we may increase our dividends; but the charge per 1000 cubic feet on account of capital will still fall.

INCREASED SALES.

The sale of gas has been 4¾ per cent. greater than in the corresponding half of 1908. This means, in quantity, 515 million cubic feet, and £70,000 in money. We have thus overtaken the loss of revenue due to the reduction in charge for gas, and have £25,000 to the good. I hope the future may prove that the lower price of gas opens up new applications and wider uses, and that our prosperity is not due simply to the sunless days of which we had so many before Christmas. The check to the development of the sale which we have experienced during the past decade was due to the competition of electricity and the vast improvement in gas-burners. As the demand for the former becomes satisfied and our district is fully furnished with economical burners, we shall hope to see what may be called normal rates of increase return. The increase in the number of our consumers continues. We have added during the half year now closed 18,000; and we have sent out altogether 35,000 additional stoves. These have brought in a further rental of £3000, and augur well for the future consumption of gas.

COST OF COAL AND OIL.

There has been a reduction in the cost of coal of £72,000. This is partly due to the new contracts under which we are now working; these contracts having been made at a lower price than the previous ones. The reduction is also partly due to a larger make of gas per ton. The cost of oil was £16,000 less than in the corresponding period of 1908, due partly to the fact that the new contracts are at a considerably reduced price, and also to better working. Since 1904, we have increased by 10 per cent. the quantity of gas made per ton of coal. Had the make continued as in 1904, the tonnage of coal carbonized in 1909 would have been greater than was actually needed by about 180,000 tons. To the corresponding improvement effected in the yield of gas from oil, we owe a reduction in the same period of 2½ million gallons. The saving on these two items, coal and oil, in the year amounts to £82,000. Our manufacturing, salaries and wages, and purification are all better. The wear and tear (manufacturing) shows an increase of £13,000. Against the large saving in the cost of coal and oil, we have to set a reduction in the revenue for residuals of only £26,000. In the distribution section of the revenue account, nothing calls for comment except the repairs and renewals of meters, which show an increase of £10,000, due to the fact that more meters are now being returned for repair and a freer condemnation of old stock. Management charges show an increase of £3500. Of this, £1000 represents the addition to the Directors' fees; and the remainder is accounted for by expenses attending upon the amalgamation.

CO-PARTNERSHIP AND OTHER ITEMS.

The charge of £13,000 for co-partnership calls for no comment. Parliamentary charges are higher than last year, including, as they do, much of the cost of the Company's Bill in Parliament. To the same cause is also due the special charge of £12,000 for stamp and conveyance duties. As you will see, the latter charge is "on account;" but we do not expect it to be increased more than a few hundred pounds when the exact figures have been ascertained. The other items on the revenue account show but little fluctuation, except the rental of fittings, which has increased by some £10,000.

FINANCIAL RESULTS.

The financial result of the half-year's working is that, after providing for fixed charges, setting aside £10,000 towards the redemption fund (in accordance with the provisions of the Company's Act of 1903), and contributing £10,000 to the insurance fund, there remains a balance of £400,402 14s. 8d., to which has to be added the amount brought forward from the previous half year of £409,893 4s. 4d. This makes the total sum available for distribution £810,295 19s., out of which the Directors recommend a dividend on the ordinary stock at the rate of £4 13s. 4d. per cent. per annum, which will absorb £353,302 14s. 4d., and leave the sum of £456,993 4s. 8d. to be carried forward to the credit of the current half year. I am glad to be able to report that the condition of the works throughout is excellent; and that the whole of the manufacturing plant is in admirable order. One of the largest retort-houses at Beckton, containing retorts of small sectional area, will be refitted this year at a rather heavy cost as against revenue. At the Stratford Station, late West Ham works, important reconstruction is already in progress. The vertical retorts installed at Kensal Green have rendered good service this winter.

THE AMALGAMATION.

The Company's Bill in Parliament received the Royal Assent on Aug. 16 last; and the amalgamation of the West Ham Gas Company with this Company took effect on Jan. 1. It is an early date yet to speak of the working of the amalgamation; but I can at least say that there is every prospect that it will be of considerable advantage to both the Companies concerned and to the consumers. The announcement of a further reduction in the price of gas, of 1d. per 1000 cubic feet, has been made by the Directors with much satisfaction. This is the fourth reduction within 5½ years.

COAL OUTLOOK.

During the past few months, there has been considerable unrest at the collieries in the North; but I am happy to say that we have had ample supplies of coal during the winter, and have now a large stock at the stations. We have no cause for anxiety in this regard. The disputes at the collieries appear to be practically settled; and there is good reason to hope that full work will soon be resumed, and the supply abundant.

INCANDESCENT LIGHTING.

We have during the half year revised our charges for mantle maintenance; and we hope that by this means we will secure a large increase in this important branch of the Company's business. The Directors feel assured that if consumers realize the advantages now to be claimed in this direction, they will hasten to avail themselves of the opportunities offered. The success of incandescent lighting largely depends upon proper attention being given to the mantles; and the Company can guarantee that this shall be efficient if the consumers will put the care of their burners in our hands.

THE SECRETARY'S SALARY.

You will see from the report that the Directors recommend an increase in the salary of the Secretary. In 1903, the shareholders fixed his salary at £1000, and at this amount it has remained. The duties of the office are, like those of all our officers, steadily increasing. We have dealt with the others; but the Secretary is in your hands. We have every reason to be satisfied with the way in which Mr. Rayner fills his important post; and we recommend that his salary be raised to £1250 from Jan. 1 last.

MUNICIPAL TRADING IN ELECTRICITY.

Before closing my observations, I desire to say a few words on a question of much importance to us—that of municipal trading in electricity, particularly in its competition with gas. The decrease of 2096 in the number of public lamps lighted by the Company's gas, is due entirely to preferential treatment of electricity by interested local authorities. Since the advent of the incandescent gas-mantle as a practical method of street lighting, no local authority in this Company's district has adopted electricity largely for public lighting, except where the local authority have had their own electric light works. On the other hand, gas has always beaten electric light in fair, open competition where the local authority have no axe of their own to grind and the two services have competed on their merits. In other words, only when the buyer of light has been also the seller of one particular form of light, has that form been preferred to gas. In the latest instance—that which has entailed the loss of the lighting of 2000 lamps—the Borough Council never notified this Company that they desired to reconsider the question of their street lighting, or asked us for any quotations for a new contract. The Electricity Supply Committee, having knowledge of the cost of the existing gas lighting, submitted a scheme for the lamps adjacent to their cables, which showed a very small saving over the cost of gas. The candle power of the electric lamps specified was only two-thirds of the candle power which the existing gas-lamps were easily able to provide, if properly looked after. The Borough Council then appointed a Special Committee to consider the

question of street lighting—which Special Committee had, for three of its five members, the Chairman and two members of the Electricity Committee, upon whose scheme they were supposed to be giving an impartial report. This Special Committee on Street Lighting did not even communicate with one of the two contractors who were in a position to quote them for public lighting; the one ignored being the Gaslight and Coke Company. The Company were privately advised of the proposals of the Special Committee; a letter of protest was addressed to the members of the Council; and proposals were made for improving, and at the same time reducing the cost of, the existing gas lighting. But to no purpose. The Electricity Supply Committee a once discovered that their quotation was £1300 a year more than it should have been; and the Council decided to adopt their scheme, overlooking or ignoring the fact that the reduction of £1300 a year came out of their own pockets—they being the sellers as well as the buyers. Accordingly, application was made to the London County Council for a loan to cover the cost of the alterations. This application was made the subject of a strong adverse report by the Finance Committee, who, after the fullest consideration, decided that the substitution of electricity for gas would not be to the advantage of the inhabitants either as citizens or as ratepayers; and the application was unanimously refused by the London County Council. The advocates of electricity at any price were not to be diverted from their intention of capturing the street lighting by any such obstacle as the opposition of the London County Council. Not being able to borrow the money for the work, the Borough Council decided to utilize the balance they had in hand and to anticipate future profits in order to provide the necessary funds. Whether their action in so doing was legal or not, I will not here inquire; for, however that may be, the work is done. We have lost our business; and the ratepayers are substantially out of pocket as a result—among the ratepayers being the Gaslight and Coke Company to the tune of some £7000 per annum. That the ratepayers are losing money is due to the fact that the cost of the street lighting by electricity, *plus* the heavy loss which their electrical undertaking is undoubtedly making on the contract (though the responsible administrators will never admit the fact), much exceeds the price at which this Company were prepared to light the streets more efficiently than they are now being lighted, despite the fact that the electric lamps now being used in the principal streets are of higher candle power and are consuming more current than those which were originally intended to be used. The Borough Council are now contemplating the installation of electricity in all their remaining gas-lamps, though the Electricity Committee have had to quote a still more unremunerative price in order to compete with us. It remains to be seen whether, and whence, the money will be forthcoming to finance the alteration. This story seems little to the credit of the system of municipal trading in electricity.

The Electric Lighting Act of 1882, which has borne these fruits, was intended to give municipal bodies preference in electricity supply; and its fundamental assumption was that local authorities would prove as competent as companies to carry on this kind of business. Therefore, it seemed good to Parliament to prevent the appropriation by private speculators of what was held to be likely to become a profitable trade. On the face of appearances at that period, there was no gainsaying this *prima facie* case for entrusting public electricity supply to local authorities; while the affirmative assumption was supported by the common knowledge that gas and water supply, originally provided by private enterprise, had in numerous instances been taken over, and was successfully conducted, by public bodies. One vital circumstance invariably attaching to these transactions was, however, quite overlooked or disregarded. Both gas and water supply had long ceased to partake of the nature of speculative investments. Nearly all, if not all, municipal acquisitions of the kind were successful examples of well-developed private enterprise; and there was nothing problematical about their financial future, nor experimental in their operations. Moreover, the correct principles of successful administration and management had become a settled tradition; and the inexperienced public bodies, on assuming direction of these old-established undertakings, had the advantage of being advised and served by the same trained executive that had helped to create the property. Yet, with all these safeguards and facilities for successful municipalization, it has not always followed that the result has, in the long run, justified the transaction. Too often, in regard to gas, a small immediate benefit has been outweighed by the erection of an administrative system conceived in the alleged interest of the "ratepayers," distinguished for the purpose from the rest of the community, including the consumers. The price of gas is kept up, ostensibly to protect the ratepayers whose credit is pledged for the financing of the undertaking, really to subsidize the spending departments of the municipality and conceal their extravagance from the public. So far, however, it must be admitted that the ratepayers do not suffer. It has been reserved for municipal electricity to show the seamy side of municipal trading. The event has proved, in my opinion, that it was a mistake to admit so speculative an enterprise as electricity supply within the scope of municipal affairs. With few exceptions, such ventures with public money have been unfortunate. Generally, theirs is an experience of disappointment, and failure to pay their way. Heavy annual charges are borne upon the rates, notwithstanding the omission to provide sufficiently for a depreciating investment, and the transfer of undisclosed expenses to other accounts. As in the instance already referred to, the nominally controlling superior authorities may refuse further capital loans; but their limited powers are defied. Whither is all this tending? If I speak strongly, I think the patent facts are my justification. Who shall raise a protest against so grievous a miscarriage of the system inaugurated with such different views and hopes more than a quarter-of-a-century ago, if not we who are so heavily mulcted in rates to support this unfair rivalry? We are not afraid of competition, so long as it is by traders like ourselves. What we do complain of is this reckless competition, without count of the cost, on the part of amateurs elected for a few years with power to play ducks and drakes with the ratepayers' money, secure in the knowledge that no responsibility will follow them when they lay down their offices. I think this situation, for which there is no legislative remedy, calls for searching investigation and prompt action. Neither the Local Government Board nor the Board of Trade appears to possess powers adequate to deal with the emergency which has arisen; and I venture to suggest that one or the other, or the Treasury, should procure the appointment of a Commission, or a Committee of Inquiry, having the necessary competence.

I beg leave to move—"That this meeting do agree with, and confirm, the report of the Directors and the Auditors' report and statement of the accounts of the Company as transmitted to the proprietors on the 27th ult."

Mr. ULICK J. BURKE (Deputy-Governor) seconded the motion.

DISCUSSION.

Mr. H. D. HALL congratulated the Board on the successful report. He had listened with pleasure to the full explanation of the gradual change of policy which originated some years ago in keeping the capital account right, because it had had the effect of increasing the value of the Company's stock, as evidenced by the market quotations on the London Exchange. It was particularly gratifying to them to know that this was caused not only by a good, sound financial policy, but by a saving in the cost of manufacture. He was also pleased to hear that, in addition to the saving in the price of coal and oil, there had been an increase of 10 per cent. in the production of gas from the coal; and he thought the thanks of the shareholders were due not only to the Board but to the staff of engineers and workmen employed in producing so satisfactory a result. He did not quite know why the Company should have been charged £12,000 for stamp and conveyance duties; and he should be glad of an explanation as to this. Also, with regard to Account No. 14, on the left-hand side they were debited with reserve fund, insurance fund, and depreciation fund, and during the half year there had been added as interest to the reserve fund £959, insurance fund £1592 odd, and depreciation fund £1061. He asked how these sums were arrived at, because it seemed to him to be rather small interest, taking the reserve fund, of £67,000, to earn only £959 for the half year. Also, he noticed that the amount invested was £211,000; and he asked if there was any objection to a rough list of the investments being given in the accounts, as was done in a great many companies; and whether any part of the £211,000 was set aside for the reserve, insurance, and depreciation funds. He had listened to the well-thought-out argument with regard to the injustice to the Company inflicted by the enthusiastic county councillors; but he was sorry the name of the borough had not been mentioned. He hoped the Board would succeed in getting either a Commission of Inquiry or a Committee to inquire into the matter.

Mr. H. C. PELLY said as a stockholder in the Company he had no question to ask; but as a Director of the old West Ham Gas Company he could not allow this opportunity—the first since the amalgamation—to pass without acknowledging the way in which the Gaslight and Coke Company had carried out their obligations to the West Ham Company under the recent Act of Parliament; and he hoped the results of the amalgamation would come up to their expectations. He thought it must be as great a satisfaction to the Governor and the Board that the amalgamation had come about, as it was to the stockholders of the West Ham Company. It was true that the Gaslight and Coke Company was vastly larger than the West Ham Company, but still the latter Company was a very vigorous one, and was rapidly growing. He ventured to think that, with the nursing it would receive from the present Board, it would continue to develop and maintain the large increase of 4¾ per cent. He thanked the Chairman sincerely for welcoming the West Ham stockholders to the meeting; and he was sure the support they had hitherto given to their Board would, in the future, be continued to the Gaslight and Coke Company Board.

Mr. KILLINGWORTH HEDGES, as an old shareholder, desired to preface his remarks by agreeing with the first speaker (Mr. Hall) in saying that their success was due to the able management of the Board. He also desired to testify to the very intelligent interest shown by members of the staff in taking up anything which was likely to promote the interests of the Company. Some time ago, he began to use gas-stoves throughout his house; but they were not altogether satisfactory as a substitute for coal-fires. Then he made experiments; and he was enabled to reduce his gas bill to a certain extent. He then got an idea from their Chief Inspector, and he was encouraged to proceed with his experiment, and he had produced a simple apparatus which could be had upon the hire-purchase system. He thought more attention had been given to lighting than to heating; but he paid a tribute to the liberal way in which the Company had met him with a view to popularizing gas-stoves.

The GOVERNOR: Let me first of all say how highly the Board appreciate the graceful remarks by the Deputy-Chairman of the West Ham Gas Company (Mr. Pelly). Nothing could have exceeded the businesslike way and the friendly manner in which the negotiations were conducted; and when the matter is a *fait accompli*, it is very gratifying to find everybody satisfied all round. Replying to Mr. Hall, I must refer him to the Inland Revenue Commissioners as to why we are made to pay so large an amount for stamps and conveyance. Of course, the King's Government must be carried on; and that is one of the ways in which money is found. With regard to a list of investments, I do not know there is any objection to one being published. The investments are in India 3 per cent. stock, £66,943; in 2½ per cent. Consols, we have £116,901; and in the Gaslight and Coke Company's ordinary stock (a temporary matter in connection with the arrangements with the West Ham Gas Company), £28,000—making £211,000 in all. With regard to the interest, where the amount is not fully invested in securities outside the Company, we charge the Company with 3 per cent.; and we carry that to the credit of the fund. The depreciation fund is not invested outside, but is invested in the Company's ordinary stock. Mr. Killingworth Hedges has acknowledged the friendly manner in which we received his proposals for improving gas-stoves; and I can only say that this is a matter which occupies the attention of our officers and ourselves constantly. We are as keen as any consumer can be to increase the efficiency of gas-stoves; and he has rightly said that any inventor who has a proposal to bring forward is quite sure of a welcome from the Company.

The resolution was then carried unanimously.

THE DIVIDENDS.

The GOVERNOR: I will now ask the Secretary to read the proposal as to dividends.

The SECRETARY: "(1) That the sum of £10,000 be set aside out of the divisible profits of the Company for the half year ending on the 31st day of December last towards the redemption fund, in accordance with the provisions of the Company's Act of 1903; and (2) That a dividend as follows for such half year be declared—viz.: On the 4 per cent. consolidated preference stock at the rate of £4 per cent. per annum, on the convertible 5 per cent. preference stock at the rate of £5 per cent. per annum, on the 3½ per cent. maximum stock at the rate of £3 10s. per cent. per annum, and on the ordinary stock at the rate of £4 13s. 4d. per cent. per annum—subject to deduction of income-tax."

The GOVERNOR: I beg to propose the adoption of this recommendation.

The resolution was seconded and carried unanimously.

RE-ELECTION OF DIRECTORS.

The retiring Directors, Mr. Ulick John Burke and Mr. Herbert Jameson Waterlow, were re-elected, as also were the Auditors, Mr. John Allen Stoneham and Mr. John James Walker.

INCREASE OF SECRETARY'S SALARY.

The GOVERNOR: I now propose, as I promised earlier to do—"That the salary of the Secretary be increased, as from the 1st of January past, by £250 per annum."

Mr. THOMAS WILKINS: I have much pleasure in seconding that.

The resolution was carried unanimously.

Mr. RAYNER (Secretary): Ladies and gentlemen, I can only thank you very sincerely indeed for having adopted this recommendation of the Directors for making such a handsome addition to my salary, and express the hope that I shall prove myself worthy of it.

VOTES OF THANKS.

A vote of thanks to the Chairman and Directors having been passed unanimously,

The GOVERNOR said: On behalf of my colleagues and myself, I thank you cordially for this vote. I see no reason why these very amicable and cordial meetings should not continue for a long time to come; and I think the prospects before the Company are sufficient to satisfy even the wishes of the Governor. Allow me now to propose a vote of thanks to the officers of the Company; and I should like to include in that the workmen also, because I believe that all round there is a spirit of devotion to the Company.

The resolution was carried unanimously.

Mr. D. MILNE WATSON (General Manager): I thank you very much indeed, on behalf of the officers and workmen generally, for the very kind way in which you have received this motion. It has always been our desire to do our best for the Company; and these resolutions, which you pass so cordially, are a great encouragement to us all to go on in the same way.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Saturday, at the Offices, No. 639, High Road, Tottenham—Mr. CORBET WOODALL in the chair.

The SECRETARY (Mr. E. Topley) read the notice calling the meeting; and the Directors' report and accounts were taken as read.

CAPITAL IN RELATION TO BUSINESS.

The CHAIRMAN, in moving the adoption of the report and accounts, said he had again a very pleasant story to tell. The Company showed, as the report informed them, a considerable amount of growth; and so long as this growth continued, there was no reason why they should have any fear for the future of the Company. He would draw the attention of the proprietors to a few of the salient figures in the accounts. During the half year there had been spent on capital account £14,528. More than half of this was for mains, service-pipes, and meters; some of the mains being of large diameter, and necessary in order to carry gas over the very extensive area served by the Company. That the capital was not extravagantly spent was shown by the relation obtaining between the amount of business done and the amount of money expended on capital account. The capital per million cubic feet was now £436. This was £10 per million feet less than last year, and £114 less than it was ten years ago. At the risk of wearying the proprietors by repeated reference to what he regarded as this most important matter, he would quote one or two further figures which had been prepared by the Secretary. In 1899, ten years ago, the price of gas was 3s. per 1000 cubic feet, and last year it was 2s. 5d.; so that the reduction had been equal to 7d. per 1000 cubic feet. Ten years ago, the charge for dividends and interest upon the capital amounted to 8·9d. per 1000 cubic feet—that was to say, for every 1000 cubic feet of gas sold, they required, to pay the dividend and the debenture holders' interest, nearly 9d. per 1000 cubic feet. Last year the amount needed for the same purpose was 6d.—a difference of practically 3d. per 1000 cubic feet. So that of the 7d. reduction in price, nearly half—40 per cent. at any rate—of the saving was due to the careful manner in which the capital had been watched and expended. The Company had effected very considerable economies in manufacture by the introduction of machinery, and by the improved methods of handling both the raw material and the products used and produced at the works. But all of these changes together were not much more than equal to the advantage gained by the careful and successful way in which capital had been issued. In the ten years, the output of gas had improved by 170 per cent.; while the amount of capital had been raised by 110 per cent. only. In the decade, the number of consumers had increased from 15,983 to 53,700. The percentage of growth in the number of ordinary meters was 113; but the percentage growth of the prepayment meters was 337. Naturally, the average quantity of gas used by the consumers was less now than it was, because the prepayment consumers took a comparatively small quantity. But he was glad to say these latter had shown in the ten years an average increase in consumption of 13 per cent. per meter. An interesting result of connecting so large a number of additional meters was that, whereas in 1899 they had 129 consumers per mile of main, they had last year 247. He did not know anything that illustrated better the manner in which the use of gas had become essential to the population as a whole.

REVIEW OF THE REVENUE ACCOUNT.

The revenue account showed that, although the price charged for gas was less than in the corresponding half year, the receipts had been larger by £2569. The rental for meters, stoves, fittings, and maintenance of mantles exhibited together a gain of £1400; and residuals were £63 more. On the other side, the purchases of coal and oil had been made on more favourable terms, and the results of manufacturing had also been materially improved. They had, in effect, used 3700 tons more coal, and paid only £147 for it. There had been a small decrease in carbonizing wages, and a large increase in the expenditure upon repairs and maintenance of works and mains, a large proportion of which expenditure was for labour. This was a matter to which he was not sorry to have an opportunity of drawing attention. One of the drawbacks of the economies that had been effected in gas-works generally was the fact that, in the carbonizing department, the number of men employed had been materially reduced. But, as he had had occasion to remark before, the end and aim of gas companies, if they were to prosper, must be to increase the output; and they could only do this by reducing the price. Now, as the price of gas was reduced, and the output was increased, so the number of men necessary in order to produce the gas increased. But, on the other hand, because of the manner in which the increase was achieved—that was to say, through the use of gas for heating and cooking and so forth—there was a vast augmentation of the number of men employed in making the appliances, and (so far as the Company were concerned) in introducing them to, and in fixing them for, the consumers. Therefore, in one direction, there was a reduction in the number of men employed; but, taken on the whole, there was a large increase in the number employed, through the varied and extended operations of the Company.

THE GENERAL RESULT.

Comparing with the corresponding half year, deducting the savings on one side (£3600) from the extra payments (£5361) on the other, they had a net increase of expenditure of £1760. The total receipts being greater by £4027, the difference or £2267 was the additional profit in the half year. Out of this profit they were able to pay the full statutory dividends, and carry forward £20,682, as against £18,592 brought from the accounts of the previous half year. This very satisfactory position of their financial affairs was due to no unusual or fortuitous circumstances, but to the continued growth of the demand for gas, and to the steadily improving results obtained in carbonizing. There was still room for improvements. This was a time of progress in the industry; indeed, he could hardly remember through his long connection with the Company a time at Tottenham when it had not been a period of progress. The Directors saw no reason why the present year should not be as prosperous as the past, or more so. The Board had bought a substantial portion of the coal requirements from June forward at the prices obtaining for the current contracts, and the supply of oil to December, 1911, at a very much reduced price. Under these circumstances, they had not hesitated to announce a further reduction in the price of gas to the consumers, bringing the charge per 1000 cubic feet to 2s. 4d. With this reduction came, as the proprietors were aware, an increase of 2s. 6d. per cent. in the dividend.

ELECTRICITY COMPETITION AND BURNER MAINTENANCE.

The Company had had in the last year some experience of electrical competition; but so far it had not had any serious effect upon them. When incandescent gas-burners were kept in good condition—especially the inverted type—they gave so beautiful a light that it could hardly be improved upon, while the quantity of gas burned was so small as to make the cost beyond the reach of competition. Most of their neighbours who were using electricity continued the use of gas, and in some places the current was generated by means of a gas-driven motor. The Company were now maintaining incandescent burners free of charge for labour—charging only the cost of the materials employed. He would strongly urge upon all consumers of gas to fall in with this arrangement on grounds both of economy and efficiency. It would be greatly to their advantage.

CO-PARTNERSHIP.

With regard to co-partnership, he firmly believed the employees were thoroughly well pleased with their position; and the Directors felt that their anticipations in regard to the scheme were in process of being realized. He did not by any means say that all had been accomplished they had hoped for. These radical changes did not reach full fruition at once; but they believed that the improvement in the effort, energy, zeal, and capacity of the employees would proceed from year to year, as the workers realized how much their future prosperity depended upon their own endeavours. He had mentioned that the reduction of 1d. in the price of gas would add 2s. 6d. per cent. to the dividend of the shareholders. It would also add ¾ per cent. to the bonus paid to the workers. This was the second time within the short period that the scheme had been in operation that the percentage had been altered in the direction of improving the return to the co-partners. They commenced with a bonus of 4½ per cent. on the wages; it was now 6 per cent.; and the end was not yet by any means. Of the total number of co-partners (601), 519, or 86 per cent., were now stockholders. The trustees had had to deal with a total sum of £9435, of which some £3000 represented money brought in by co-partners out of savings prior to the adoption of the scheme. This had been dealt with as follows:—

Value of stock transferred to co-partners	£4995	19	4
Withdrawals of half bonus	244	0	0
Withdrawals of deposit cash	247	16	6
Payments to co-partners who have left Company's service [This was simply waiting until the amounts grew large enough to allow of their being invested.]	90	19	10
Balances owing to co-partners on trust account	1616	12	8
Balances owing to co-partners on "withdrawable" account	2739	17	5
	£9439	5	9

The small percentage of the bonus which had been withdrawn was one of the very satisfactory features of this statement.

FURTHER CAPITAL REQUIRED.

He had only to add that the Company were in need of funds. The capital raised had been overspent by £40,000; and they were necessarily dependent on their bankers and upon their uninvested balances of profit and loss, and reserve and insurance funds for working capital. This was good finance in that they were able to find the money on better terms than they would have to pay the shareholders who subscribed for additional stock. But this must not be carried too far. They owed their bankers at the present time £40,000. The Directors had therefore decided to offer next month £30,000 of stock to the shareholders and public at a minimum price of £111. To those of the Company's friends who had funds to invest, they did not hesitate to say, "You can hardly find a better way of placing it."

Mr. HENRY BAILEY seconded the motion. In the course of his remarks, he said that perhaps the most important matter they had to deal with was the question of co-partnership. The Directors had expected it to be a great success; and they had not been disappointed up to the present time. As the price of gas was lowered, the more difficult would it become to make further reductions; and therefore it depended greatly on the co-partners as to the profits in the future. Each one must do his best in his own department, because the Directors could not do everything, nor could the officers. Without the aid of the workers, reductions became problematical.

AUTOMATIC LIGHTING MECHANISMS—UNACCOUNTED-FOR GAS.

Mr. EDWARD SAWYER asked whether it was possible to tamper with the automatic mechanisms fixed to the public lamps for lighting and extinguishing them, because he had had occasion to drive boys away from lamps in his neighbourhood who were attempting to interfere with the mechanism.

Mr. HAWARD referred to the unaccounted-for gas, which amounted to nearly 8 per cent. A year or two ago they had a high proportion; then there was an improvement. Now they appeared to have fallen back again.

The CHAIRMAN, in reply, said far be it for him to put limits to the possibilities of small boys in regard to mischief-making; but so far as he knew, it was almost impossible for boys to do damage to the self-lighting arrangements which were adopted so generally throughout the district. With the arrangement they were very well satisfied; but there had been causes of complaint. The Company had now taken the maintenance of the automatic lighters entirely into their own hands, instead of leaving them with contractors, as had hitherto been the case. He felt sure there would be no trouble with them henceforth. With regard to the amount of unaccounted-for gas, he thought he had stated before that, for some reason which he could not undertake to adequately explain, the unaccounted-for gas in the first half of the year was always much less than in the second half. He believed it had something to do with the collection of money from the prepayment meters; but he could not say exactly how. Take the last five years. In 1904, the average was 7½ per cent.; in the Christmas half of the next year, 7·86 per cent.; in the June half, 2·87 per cent. So it went on. In the December half of last year, it was 8·64 per cent.; and in the June half it was 1·67 per cent.—the average being about 5 per cent. As Mr. Haward had said, the average last half year was nearly 8 per cent., or 7·64 per cent. This was 1 per cent. less than it was in the corresponding half year.

The motion was unanimously carried.

THE DIVIDENDS.

Sir DANIEL F. GODDARD, M.P., proposed the declaration of dividends at the rate of 6⅞ per cent. per annum on the "A" stock, and 5⅜ per cent. per annum on the "B" stock, both less income-tax. In the course of his remarks, he referred to the mistaken notion on the part of a section of the public that it was the easiest thing possible for a gas company to earn a dividend; but he knew, from his own experience, that it involved a great deal of hard work and constant attention on the part of everybody connected with the undertaking. In the gas industry, in every department, things were advancing so fast that it was a constant struggle to keep up to the mark; and it was only by the heartiest co-operation of all in the undertaking that they could accomplish results such as were seen in the report. Above all things, the Company were fortunate in having at the head of affairs one who held such a high position in the gas industry as Mr. Corbet Woodall. He always had kept everybody up to the mark; and he (Sir Daniel) was sure he would always do so.

Mr. G. T. WATSON seconded the motion, which was adopted.

VOTES OF THANKS.

On the proposition of Mr. MICHELL, seconded by Dr. SCOTT, a cordial vote of thanks was passed to the Chairman, Directors, and Auditors.

The CHAIRMAN, having responded, moved a vote of thanks to the chief officers, staffs, and workmen of the Company. Of Mr. Broadberry, he could not speak in too high terms. He (the Chairman) did not think any Company could have a servant who was more thoroughly devoted to his work, and who more conscientiously fulfilled the duties that fell to him. The same remarks would apply to the Secretary.

Mr. ROBERTSON seconded the motion, and it was heartily carried.

Mr. BROADBERRY responded on behalf of himself, his staff, and the workmen. In the course of his observations, he said the Chairman had referred to the displacement of labour by stoking machinery. He did not say, however, as he might have said, that stoking was the most exhausting part of any of the workmen's duties. He (Mr. Broadberry) knew of many of the stokers who were co-partners who were grateful to the Directors for having introduced machinery, for it had enabled them to continue their work when Nature would have failed them if they had been compelled to go on working in the old-fashioned manual way. Though using machinery, the men were getting good wages.

Mr. TOPLEY also acknowledged the vote on behalf of himself and the secretarial staff.

YORK UNITED GAS COMPANY.

The Half-Yearly Meeting of the Company was held at the Merchants' Hall, Fossgate, York, last Thursday—under the presidency of Mr. JAMES MELROSE, J.P. (Vice-Chairman).

The SECRETARY and MANAGER (Mr. J. H. Hill) read the 131st half-yearly report and balance-sheet. This showed that the balance of profit amounted to £8491, to which had to be added £358 interest on the reserve fund, making £8849; and after payment of £618 interest on the debenture stock, there remained a surplus of £8231. The Directors recommended the payment of a dividend at the rate of 4 per cent. per annum on the preference stock and the consolidated ordinary stock. There was an increase in the quantity of gas sold, compared with the corresponding half of the previous year, of over 4½ million cubic feet. During the six months, 1366 yards of additional mains were laid, and 605 meters fixed for new consumers. The Directors reported, with the utmost regret, the death of their colleague, Mr. Matthew Leaf, after 55 years of devotion to the interests of the Company. They desired to record their deep sense of personal loss, and their high appreciation of the inestimable value of Mr. Leaf's untiring service and unrivalled knowledge and experience.

The CHAIRMAN, in moving the adoption of the report and balance-sheet, said his first duty was to express regret for the absence of the Chairman (Mr. J. R. Hill). Other members of the Board were also absent; but the unfilled place which they most deplored was occasioned by the death of Mr. Leaf. Only those who had been long associated with him in the service of the Company could fully appreciate what the loss of his ripe experience and sound advice meant. In presenting the record of operations for the past half year, there was little for him to say beyond what appeared in the report. After paying the interest on the debenture stock and providing for the usual dividends on the preference and ordinary stocks, they carried forward a surplus of £321, which was a little more than the surplus carried forward last half year. They also had the satisfaction to report a continued increase in the quantity of gas sold, and a steady growth in business in all directions. While the laying of the new tramway lines had been in progress, they had taken the opportunity of examining the mains and of executing renewals and repairs where required. The plant generally had been maintained in a state of efficiency; and they were making provision for such renewals as appeared necessary. For some time it had been felt that the accommodation in the Davygate premises was capable of improvement and extension; and the property now acquired would enable them to make alterations of considerable advantage.

The report was adopted, and the dividends agreed to.

Major LINDBERG moved a vote of thanks to the Chairman and Directors for the efficient manner in which they had conducted the business of the Company during the past half year, and also to the Secretary and Manager. He was sure every shareholder would endorse the remarks of the Chairman with regard to the late Mr. Leaf. They all appreciated the loss the Board had sustained by the death of so valuable a colleague.

Mr. JOHN CROSS seconded, and also expressed regret at the death of Mr. Leaf. He referred to the excellent manner in which the business had been conducted.

The motion was unanimously carried.

CO-PARTNERSHIP AT CARDIFF.

The Annual Meeting of the Cardiff Gas Company was held at the Offices, Bute Terrace, last Wednesday, under the presidency of Colonel WILLIAM TAYLOR, M.D.

The CHAIRMAN, in proposing the adoption of the report and accounts for the twelve months to Dec. 31, remarked that the Company were making very satisfactory progress in every way. The use of gas had widened out in all directions. They had not to resort to the practice of fixing lights for nothing in order to attract business, as was being done by some in Cardiff. The revenue for the year was something like £4000 more than the previous year; and the output of gas, notwithstanding competition, was 21 million cubic feet more. They must not, however, expect the increase to continue to be so much, as the incandescent system materially reduced the quantity of gas used. With regard to the quality of the gas, this was as good as it had ever been; and when a deputation from the Corporation visited the Directors a few weeks ago, he challenged them to produce any complaints from their Analyst's report. They could not do so, as their own report showed the gas to be as high as 16·30 candles; whereas their standard was only 14 candles. An experiment had been made by one of the stove-makers in opening premises in Cardiff for the sale and hiring-out of gas-stoves; and this had been so successful that the Directors intended opening a suitable branch office and show-room in a central part of the city for the convenience of consumers generally. The returns from the different residuals sold during the year had been highly satisfactory. The question of making their own sulphate of ammonia was under consideration by the Board; and he was looking forward to profitable returns from this source. The co-partnership scheme inaugurated last year had fully realized their expectations, and meant a great saving in all directions. They had a faithful and loyal body of workmen; and they were pleased with the institute and rifle club which the men formed. They were exceedingly fortunate as a Company in having, considering the size of the district supplied by them, so few bad debts; the average being less than 5s. per £100. There were now over 12,000 slot-meters in use; and the revenue therefrom showed a progressive increase. The Directors had under consideration the possibility of being able in the near future to lower the price of gas; but, of course, they were dependent on the state of the coal market. It was their duty to let the general public have the benefit of the Company's prosperity.

The report was adopted; the usual dividends were declared; and votes of thanks were accorded to the Chairman and Directors, the Manager and Secretary (Mr. George Clarry), the Engineer (Mr. H. D. Madden), and the general staff.

CAMBRIDGE GAS COMPANY.

Adoption of Co-Partnership—Progress of the Company.

The Half-Yearly General Meeting of this Company was held last Tuesday, at the Offices, Sidney Street, Cambridge—Mr. E. H. PARKER, the Chairman, presiding.

The SECRETARY (Mr. A. E. King) having read the notice convening the meeting, the report of the Directors, with the accounts for the six months ended Dec. 31 last, was presented. The report set forth that during the half year the new offices at No. 52, Sidney Street, had been opened; and the opportunity thus afforded of displaying a large variety of gas stoves, lamps, and other appliances had been appreciated by gas consumers, and had been beneficial to the Company. The Directors had established a co-partnership scheme with the regular employees; and they expressed their confidence that it would prove as advantageous to the Company as it had been to other companies who had adopted a similar scheme. In conjunction with some fifty other companies, they had deposited a Bill in Parliament for the purposes of authorizing the adoption of the "Metropolitan" No. 2 burner as the standard burner for the official testing of the illuminating power of the gas. Since the year 1906, the burner had been adopted by the London Gas Referees, and was already the authorized burner with many companies and local authorities. The accounts showed that the total revenue for the half year was £34,922, and the expenditure £29,351, compared with £34,795 and £29,170 in the corresponding period of 1908. The balance carried to the profit and loss account was £5571, against £5624. The amount available for distribution was £21,740; and the Directors recommended the declaration of dividends at the maximum rates, less income-tax. The statements relating to the working show that in the second half of last year 193,871,000 cubic feet of gas were made, 173,993,000 feet sold, and 175,804,000 feet accounted for; the figures for the corresponding period of 1908 being 186,843,000, 167,657,000, and 169,138,000 cubic feet respectively.

The CHAIRMAN, in moving the adoption of the report, said he thought the Directors might congratulate the shareholders on the prosperity of the Company. He would like at once to say that they considered a great deal of the prosperity which the Company was now enjoying was due to the skill and ability of their Engineer and Manager, Mr. Auchterlonie. The Directors, consumers, and shareholders were very much indebted to him for the great care and ability he bestowed on the interests of the Company. The accounts for the half year spoke for themselves. There was only one item to which he wished to call attention, and that was on the debit side of the revenue account, where they would find a line "Co-partnership account, £350." This brought a new departure under the notice of the shareholders—the establishment for the regular employees of the Company of a co-partnership scheme. He hoped it would have the approval of all the shareholders. The plan of the scheme was simply this—that a bonus, varying with the price of gas, was given to every regular employee, not in cash, but in stock of the Company; at any rate, this would be the case for some time to come. It would thus be seen that very soon all the employees would become shareholders of the Company, and be directly interested in its prosperity and its economical working. He hoped that in a few years the scheme would be found working smoothly, and greatly to the advantage of all concerned. He was very glad to say the Directors were able to recommend the payment of dividends at the maximum rates. They were met for the first time in their new offices, which had been found very convenient, and which he thought would lead to a larger business being done in gas fittings, stoves, &c. On the 25th of October last, the Mayor of Cambridge was kind enough to open the Workmen's Institute and Recreation Rooms which had been built at the works. Here, again, the Directors had—he was sure with the full approval of the shareholders—been trying to do something for the employees; and he was given to understand that the Institute and recreation rooms had been found of great benefit, and had been very much appreciated by all the employees. With respect to the working, the make of gas for the half year had increased by 7,028,000 cubic feet. Perhaps the best indication of the prosperity of the Company would be shown by the figures he would now give. The increase in the ordinary consumers during the half year had been 213, and in the ordinary consumers using cookers 62. Heating-stoves had increased by 44, slot meters by 160, slot cookers by 99, and public-lamps by 10. All these increases, he thought they would agree, showed the great vitality of the Company. As to the prepayment meters, they would see how important they were to the Company when he told them that through these meters the sale of gas for the half year was 26,820,200 cubic feet, meaning in money £5031 1s. 5d. These were interesting figures, showing a large increase in the sale of gas due to the introduction of slot-meters.

Mr. STANDLEY seconded the motion; and it was agreed to.

The dividends recommended having been declared, a vote of thanks was accorded to the Chairman, Directors, and officials of the Company.

The CHAIRMAN, in responding, expressed his pleasure at hearing the appreciative remarks in regard to the services of the staff, and said he could only hope that the Directors and officials would continue to do their best in the interests of the Company, and might be successful.

The business of the ordinary meeting then closed.

The Standard Burner Bill.

A Special General Meeting was then held for the purpose of considering the Bill, of which notice has been given for next session, to provide for the adoption of the "Metropolitan" No. 2 burner as the standard test-burner.

The CHAIRMAN explained the existing conditions under which gas is tested, as prescribed by Parliament, and went on to say that the object of the Bill was to make the burner they used a fair and scientifically accurate test. The burner proposed to be substituted for the one at present in use had been approved by the Metropolitan Gas Referees after very careful experiment. They had satisfied themselves that the "Metropolitan" No. 2 burner was the best known burner for testing the illuminating power of gas; and since 1906 they had adopted it for the purpose of testing the illuminating power of gas supplied by the three Metropolitan Gas Companies. It seemed to have been proved that the burner gave a fair and true result of all qualities of gas up to an illuminating power of 20 candles; and this limit covered the statutory obligation of the Company. The burner was now invariably prescribed in all Acts and Provisional Orders conferring powers of supply upon gas companies and local authorities, and also in Acts and Provisional Orders promoted by existing companies and local authorities for further powers. Therefore it was pretty certain that it was the best. He understood that the Corporation of Cambridge would oppose the introduction of the new burner for testing purposes. The Bill was merely to authorize the introduction of the burner, and therefore it could not be amended, in the opinion of the Directors, by the insertion of any other clauses not connected with the one purpose the Bill had in view. It was a little hard to see why the Bill should be opposed, as, in the opinion of the Directors, it was an endeavour to obtain for the consumers the benefit of the best and fairest test-burner. The use of the new burner tended directly to cheapen gas; and it seemed to him that any local authority who might oppose a Bill of this kind would not be doing a good, but rather a bad, turn to the public or the gas consumer.

Various questions in regard to the Bill having been put,

The CHAIRMAN, in reply, said the reason for the opposition of the Corporation, so far as he could understand, was that they wished to introduce into the Bill provisions relating to other subjects, which, as he had said, could not be tacked on to the Bill. A great many gas companies and local authorities had been authorized by Parliament to use the new burner, which was a better test-burner, and it did justice to all the different grades of gas required for various purposes. He hoped its adoption would reduce the expenses and costs of production. If consumers had incandescent burners, they might use a cheaper gas with no ill result to anybody; and it would be as good, if not better, for motive power and heating.

The motion was carried unanimously; and the meeting terminated with a vote of thanks to the Chairman.

READING TOWN COUNCIL AND THE BURNER BILL.

Council Decide to Oppose.

At the Meeting of the Reading Town Council last Thursday, the Finance Committee presented the following report with reference to the Gas Companies (Standard Burner) Bills: "The Committee were informed that at the conference of local authorities which was held at the Westminster Palace Hotel with reference to the Gas Companies (Standard Burner) Bills, it was decided to recommend the local authorities affected by the Bills (1) to present petitions against them, (2) to take united action in the matter, (3) to share the cost of the opposition in proportion to the rateable values of their respective districts, and (4) to instruct one firm of Parliamentary Agents to act on behalf of the associated authorities save as regards the preparation and presentation of the petitions. The Committee were further informed that a Committee had been appointed to consider the details of the grounds of opposition and the concessions to be demanded (*a*) in regard to the prescription of a standard calorific power, (*b*) the prescription of a method and apparatus for testing the illuminating and calorific power, and (*c*) the extension of the times for making the official tests of gas; and that it had been agreed that each authority should have power to negotiate with the company supplying gas in its own district, and to discontinue its opposition in the event of the negotiations being successful."

Alderman J. W. MARTIN, the Chairman of the Committee, moved that the Council oppose the Gas Companies (Standard Burner) Bill (No. 2), as recommended by the Committee. In doing so, he remarked that if the members of the Council had read the able and learned report of the Medical Officer of Health (Dr. Ashby), they would have learnt that there were ample grounds for filing a petition against the Bill, so that they might see what shape it took when it came before the Committee of the House of Lords, and also to ensure that they would not have a worse quality of gas than they had at the present time, but if possible a better one. The Gas Company were acting in combination with about twenty other companies; and if it were left entirely to the "sweet will" of their dear friends and neighbours, the Gas Company, they would have no difficulty whatever in coming to some arrangement, as had been suggested by Dr. Ashby. But as they were acting in combination with the other gas companies, they could not, of course, accept the Council's terms without the consent of the other companies. The Council were not opposing the Bill alone, but were acting in conjunction with other towns.

Alderman C. G. FIELD seconded the motion.

Dr. J. HOPKINS WALTERS, in supporting the motion, expressed regret that the Gas Company could not come to terms with the Corporation; but they had really forced the Council's hands by joining with other companies. The Company were in a peculiar position, because they were limited to a 5 per cent. dividend on their shares; and whatever profit was made after this was paid, went to benefit the consumer by the reduction of the price of gas. He had the advantage of attending the conference in London, and also of seeing the proposed burner; and there was not the slightest doubt that it was a great advance on the one at present in use, so on that ground alone there was no reason why the Council should oppose the introduction of this particular burner. But there were other questions which arose, and one was the great advantage of standardizing the apparatus by which the illuminating power of gas was ascertained. It was also right that they should have some guarantee as to the heat-giving and light-giving qualities of the gas which was being supplied. With regard to the Gas Company, he thought they could be trusted to supply a good gas, because they had no interest adverse to that of the Council in the matter; and he was quite sure that they were anxious to provide the very best quality gas, and one which was suitable for the requirements of the public. Still, he did not think it was unreasonable that the Company should give some guarantee as to what this quality should be, and that they should

have a standard for heat and also for light. They had in Reading at the present time a rather low standard of illuminating power; and if the Company did not come to terms with them, he thought it was quite reasonable that the Corporation should insist upon having a much higher standard. In Liverpool and some other large towns, the standard was 20 candles; whereas in Reading it was only 14. There was another point. In the interests of the gas consumers, they must insist on a higher standard of illuminating power, if they had this improved burner, for the benefit of those who used flat-flame burners. What he should much like to see was the Gas Company and the Corporation coming to terms, because it would save the Council the expense of opposing the Bill. At the conference in London it was agreed that all corporations could negotiate with their own gas companies; and if these negotiations were successful, they were at liberty to retire from the opposition. He must say that, considering the condition of the Reading Company's finances—that was to say, that they had no personal interest in trying to "do" the public in the quality of their gas—he thought it would be very easy for the Council to arrange terms, unless the Company were so pledged to the other companies that they could not withdraw from the Bill. He was sorry that so unfortunate a position had arisen; but, under the circumstances, the Council had no option but to oppose the Bill.

The motion was carried with one dissentient.

COST OF GAS AND ELECTRIC LIGHTING.

"The Times" Controversy—Mr. Hanbury Thomas Replies.

Further correspondence on this subject appeared in the Engineering Supplement to "The Times" last Wednesday; the first letter being a reply by Mr. Hanbury Thomas, the Managing-Director of the Sheffield Gas Company, to the remarks of the contributor of the original article and to the letter of Mr. H. H. Holmes as given in the "JOURNAL" last week (p. 312). Mr. Thomas's letter is as follows.

In replying to my letter in the Engineering Supplement of the 19th of January, "Your Contributor" first deals with the question of the average price of gas, which he states is much nearer 3s. than 1s. 4d. per 1000 cubic feet. For the purpose of comparing the cost of electricity and gas, I contend that only large towns should be taken into consideration. In Field's tables I find that the average price charged for gas in 1908 by the following ten Corporation gas undertakings—Birmingham, Bolton, Bradford, Carlisle, Leeds, Leicester, Manchester, Nottingham, Oldham, and Salford—was 2s. 2·16d. per 1000 cubic feet; and the average price in the following nine towns supplied by Companies—Bath, Brighton, Bristol, Derby, Newcastle-on-Tyne, Plymouth, Portsea, Rochester, and Sheffield—was 1s. 11·17d. per 1000 cubic feet. This, I think, will materially affect the calculations on which "Your Contributor" founded his statement that metal filament lamps are cheaper than gas-mantles. "Your Contributor" also states that "the annual cost of lamp renewals is less than that of mantle renewals"—a remark which further shows how utterly unreliable his arguments are. The respective prices of metal filament lamps and mantles are 2s. 6d. to 3s. 9d. each for electric lamps, and 3½d. each for gas-mantles. This Company [the Sheffield] maintains about 27,000 burners; and the average number of mantles used during twelve months works out to 3·16 per burner, many of which are fixed in public-houses and shops, and come in for somewhat rough usage. In my own house, mantles easily last for twelve months, and, if the burners and globes are kept clean, with very little deterioration of light.

As to the amount of light afforded by the rival illuminants, I quite agree with "Your Contributor" that "the most reliable comparisons are those based on actual experience;" and I, at any rate, have not sought to argue the matter theoretically. But if the actual illuminating power developed by the respective lights is to be compared, the comparison, to be of any real value, must be based on careful determinations carried out by photometric experts. Therefore, in my previous letter I took a responsible electrician's statement as to the performance of metal filament lamps, and compared them with corresponding results obtained from incandescent mantles—the latter being purposely understated in order that the comparison might not be unduly favourable to gas.

Now, "Your Contributor" goes on to assert that the yield of light from gas-mantles falls off very rapidly from their initial lighting power. This I distinctly assert is not the case if mantles of good quality are employed; nor do they compare unfavourably in this respect with electric lamps. In proof of this assertion, I may again refer to Mr. Lavender's paper, which has been my authority for the case for metal filament lamps. I find it therein stated that the useful life of five lamps tested varied from 1500 to 2350 hours; the mean candle power developed throughout the period ranging from 80 to 98 per cent. of the initial lighting power. With regard to gas-mantles, I have found these yielding 94 per cent. of their initial lighting power after burning 2600 hours, and 90 per cent. after burning 4000 hours. Therefore, as regards sustained lighting power, I am justified in contending that the comparison is not unfavourable to gas.

With regard to the statement that "the light from electric lamps is much more easily reflected and concentrated than that from gas-lamps," such an assertion hardly deserves serious notice. "Your Contributor" will surely not contend that the light from gas is not subject to the same physical laws as that from electricity. Suffice it to say that for all practical purposes of illumination (apart, that is, from merely decorative effects) the light from incandescent gas-mantles is just as amenable to modification, by the use of shades and reflectors, as is that from metal filament lamps, with the additional advantage that, the glare from naked filaments being greater than from mantles, the unshaded light from the latter is less hurtful to the eyesight.

Regarding the matter of ventilation as affected by the method of lighting, "Your Contributor" remarks that the products of combustion are "heavier than air." As I wish to keep the argument on the plane of practice rather than of theory, I will merely remark as to this that, in gas-lighted rooms, the carbonic acid contents of the atmosphere are always highest at the highest level. On the other hand, it is well known that in electrically lighted buildings it has been found necessary to introduce gas-flames at the ceiling level in order to secure an upward current of air, and thus prevent the unpleasant and hurtful down-draughts hitherto experienced. As bearing on this matter, I may remark that some twelve months ago serious complaints were made of the impure atmosphere in the Council Chamber of the Sheffield Town Hall, where the electric light is installed and no gas is burnt. The matter was investigated by the Medical Officer of Health, who found that there was four or five times more carbonic acid gas in the room than in the street outside. Had gas been in use there, it is not difficult to surmise where the blame would have been put.

With regard to the combustion of oxygen, electricians will continue to harp on the conditions which obtained under the old-fashioned mode of illumination by flat-flame burners. With the modern incandescent burner, two of which will adequately light a good-sized room, the amount of oxygen required to support combustion is really a negligible quantity; moreover, we do not live in air-tight compartments, and with the warmer atmosphere of the room fresh air is always being drawn in, to say nothing of the replacement of oxygen every time the door is opened.

Your correspondent Mr. H. H. Holmes very correctly states that the true comparative costs of electricity and gas are the quarters' bills; and he gives sundry examples showing a saving in favour of electricity. He does not, however, state the conditions in which gas was previously used, nor whether there is still a consumption of gas which was included in the previous gas account. My general experience is that in cases where electric light has been installed there is still a considerable quantity of gas used for various purposes. I also give below several cases showing the amounts paid for gas and electricity during corresponding periods. Mr. Holmes further makes the amazing statement that electric light is going ahead tremendously, while gas is practically stationary. That this is mere imagination on his part will be seen by the following figures. During the three years ended Dec. 31, 1908, the meters in use in this Company's district (we have no penny-in-the-slot meters) have increased from 81,269 to 93,629, or 14·47 per cent.; and during the same years the consumption of gas has increased from 2,799,214,000 cubic feet to 3,328,883,000 cubic feet, or 18·92 per cent. This is in spite of the large replacement which has taken place of flat-flame burners by incandescents, and of the notoriously poor trade during the latter part of that period.

Jan. 1, 1908, to Sept. 30, 1908. . . .	Electricity .	£46	1 1
,, 1908 ,, 1908 . . .	Gas . . .	45	19 1
		£92	0 2
Jan. 1, 1909, to Sept. 30, 1909. . . .	Gas (solely) .	49	7 3
	Saving	£42	12 11
Oct. 1, 1907, to Sept. 30, 1908. . . .	Electricity .	£16	12 11
,, 1907 ,, 1908. . . .	Gas . . .	4	12 8
		£21	5 7
Oct. 1, 1908, to Sept. 30, 1909. . . .	Gas (solely) .	9	6 8
	Saving	£11	18 11
Jan. 1, 1908, to Dec. 31, 1908. . . .	Electricity .	£32	6 0
,, 1909 ,, 1909. . . .	Gas . . .	9	17 6
	Saving	£22	8 0
Oct. 1, 1905, to Sept. 30, 1906. . . .	Electricity .	£113	9 5
,, 1908 ,, 1909. . . .	Gas . . .	29	12 6
	Saving	£83	16 11

The Products of the Combustion of Gas.

The second letter is by Mr. John S. Owens, who deals with the statement by the contributor to "The Times" that "the products of combustion, being heavier than air, cannot be got rid of merely by the use of a ventilator or by keeping the top windows open." Mr. Owens writes as follows:

I think that this statement, as it stands, is misleading, especially in a paper which is so widely read, not only by the engineering profession, but also by the general public. It conveys the impression that the products of combustion tend to collect near the floor in a room, by virtue of their greater weight; but this is not a true statement of the case. It is true that carbon dioxide gas, which is the chief product of combustion, is heavier than air; 2 cubic feet of carbon dioxide weighing about the same as 3 cubic feet of air. It is not true, however, that in a room heated (say) by gas-fires the carbon dioxide exists in greater proportion near the floor than near the ceiling—in fact, it is exactly the reverse of this. I will give one case out of a long series of tests of gas and other fires conducted by me for the Coal Smoke Abatement Society; and this is not exceptional, but typical. It refers to a so-called "condensing" gas-stove, the products of combustion from which were discharged into the room. At one time, when the amount of carbon dioxide, in parts per 10,000 by volume, was 15·5 at the floor level, it was 18 at 3 feet above the floor and 20·1 at 12 feet above, or within a foot of the ceiling. Thus it will be seen that the purest air is near the floor in an ordinary room, and the most vitiated near the ceiling. In fact, the distribution of impurities is determined chiefly by the air currents in a room, and not so much by their relative densities; and these air currents are not by any means the simple matter generally supposed, as I have found by exploring the currents by a special instrument devised for the purpose. It is, however, true that, on the whole, the heated air rises and the colder descends; hence the products of combustion, if they do get into the room, are carried towards the ceiling. I would here like to say, however, that no gas-fire need discharge impurities into a room. That some of them do is evidence, not of any inherent tendency of gas to vitiate rooms heated by it, but simply of faulty design in the stove or of a bad flue draught.

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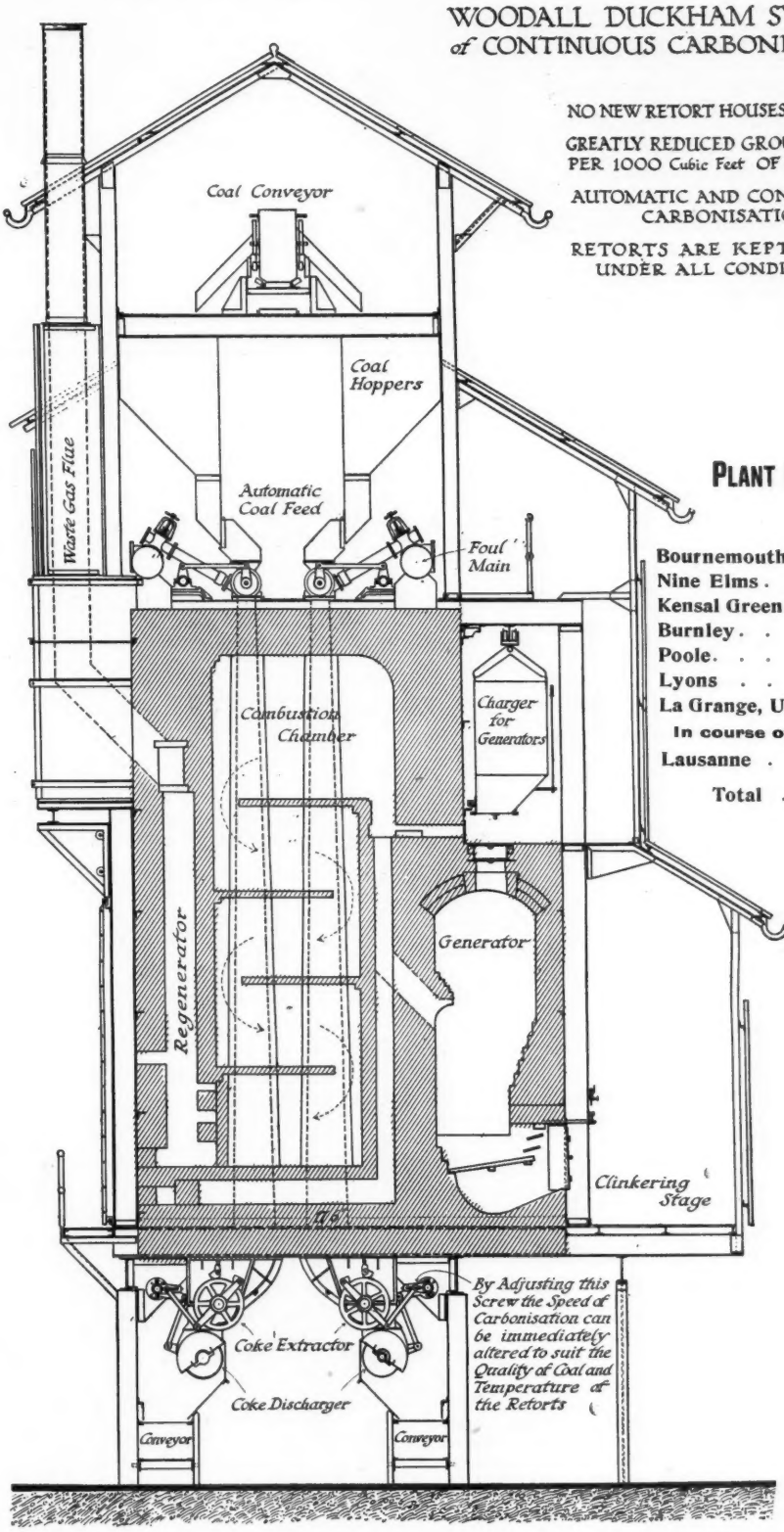

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Kensal Green	1,250,000
Burnley	1,125,000
Poole	50,000
Lyons	125,000
La Grange, U.S.A.	125,000
In course of Erection—	
Lausanne	1,500,000
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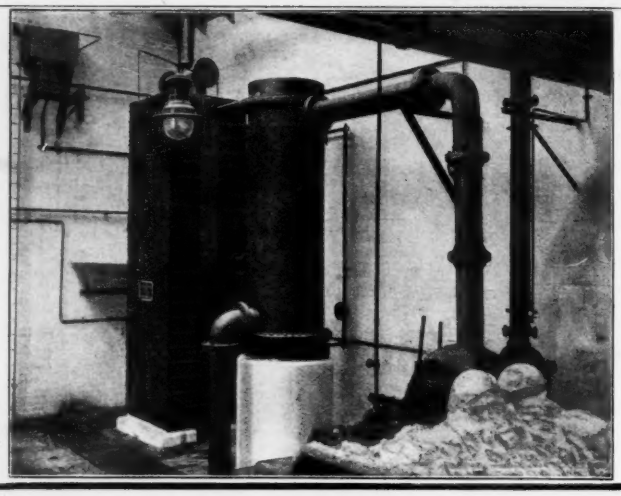

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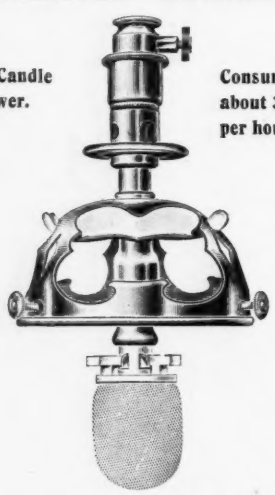

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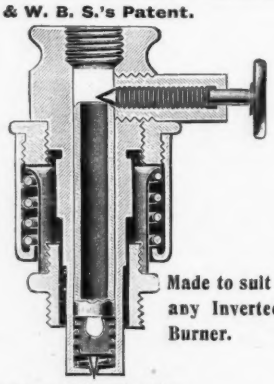

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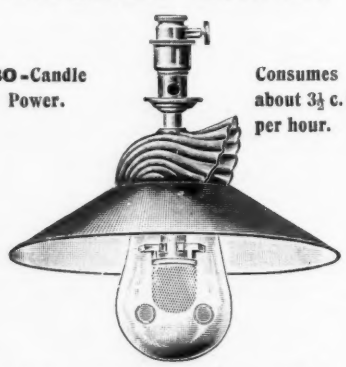

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BIRMINGHAM GAS SECRETARYSHIP.

At their Meeting last Tuesday—held under the chairmanship of the LORD MAYOR (Alderman Bowater)—the Birmingham City Council had presented to them the report of the Gas Committee, particulars regarding which were given in the "JOURNAL" for the 25th ult., p. 246.

Alderman Sir HALLEWELL ROGERS moved that the Gas Committee be authorized to fill the vacant office of Secretary and Manager of the Gas Department, and to offer such salary as they might consider reasonable. After a sympathetic allusion to the loss sustained by the death of Mr. G. Hampton Barber, he asked for the support of the Council in the trying times through which the department were passing while searching for a successor. It would, he said, be within the memory of the Council that, upon the retirement of Mr. Henry Hack, they did not recommend the appointment of another Engineer-in-Chief, but advised that the four Engineers-in-Charge be made responsible for the works under their particular control. A weekly staff meeting was organized, at which each of the Engineers was present, together with the Chief Chemist and Secretary. This combination of engineering and commercial elements proved very successful; and after careful consideration, the Committee recommended that the system should be continued. They therefore advised the Council to authorize them to fill up the vacancy by the appointment of a thoroughly competent commercial man, accustomed to organizing and controlling a large staff, and capable of buying all the coal, oil, and other material required, and also of successfully negotiating the sale of coke and other residuals. In the opinion of the Committee, it was not absolutely necessary, though it might be desirable, that he should have an intimate knowledge of gas engineering; but they did think it essential he should have had such training as would enable him to form an opinion as to the commercial value of the various proposals that the Engineers from time to time brought forward, and advise the Committee thereon. Such an official it was not easy to find; and this was why, in the resolution, no mention was made of the exact amount of salary that the Committee proposed to offer. It must depend entirely upon the qualifications of the man himself. He was quite prepared, if the Council insisted upon it, to tell them the figures in the minds of the Committee; but he trusted he would not be pressed on the point, as he was sure it would not be in the interests of the city or the department. If he mentioned a somewhat low figure, it would not attract the right candidate. On the other hand, if he mentioned a high figure, and the right candidate was not forthcoming, and they appointed someone at a lower salary than that stated, it would not have satisfactory results, inasmuch as it would show the official concerned that he was not really the man whose services they were seeking. The Council might trust the Gas Committee not to offer an exorbitant figure; but, at the same time, they felt that, having regard to the importance of the gas undertaking, and the difference it would make to the ratepayers of the city if the department were not efficiently managed, it was a wise policy to obtain the services of a thoroughly competent officer. These services could not be secured unless adequate remuneration was offered.

Mr. WALTHALL objected to the proposal, because he did not consider Sir Hallewell Rogers had given any sufficient reason why an unusual course should be adopted. Whatever salary was offered, it ought to be mentioned, as was done when Mr. Barber was appointed many years ago.

Mr. PENTLAND asked whether it was proposed to make an appointment subject to the confirmation of the Council.

Alderman BEALE approved of the proposal of the Gas Committee, as the best way to get the best man.

Mr. PARKINS asked whether, in the event of the resolution being carried, anything would be done contrary to the spirit of the amendment carried with reference to a proposed advance in Mr. Barber's salary.

Mr. JACKSON said he could not see any business end to be gained by members of the Gas Committee going about with the amount of the salary they proposed to give "tucked up their sleeves." It was far better, he thought, to state the commencing salary, and reward a man according to his merits.

Sir HALLEWELL ROGERS, in reply, pointed out that the post they were now seeking to fill was not exactly the same as that when they appointed Mr. Hampton Barber. Mr. Barber was appointed as Secretary only; but they were now looking for a rather different class of man to work with the Engineers. In reply to Mr. Pentland's question, they were proposing to fill the present vacancy in the usual way. They would bring up one name, and one name only. If he and Mr. Jackson did not agree with that name and the salary proposed, they must vote against the Committee. With respect to increases in the salary, he (Sir Hallewell) would not like to pledge himself; but they would not go further than to recommend a certain increase after a short trial. He sincerely trusted the Council would pass the resolution, because he could not agree that it would be in the best interests of the Council that the remuneration should be known at the present time. It was essential that they should attract the right man; and when they had got him, they could consider whether he was worth the salary they were prepared to offer.

Eventually the Council agreed to the following resolution: "That the Gas Committee be, and are hereby, authorized to recommend a person to fill the office of Secretary and Manager to the Gas Department, and to offer such salary as they may consider reasonable."

The report was then put and approved.

The Extensions at Burton and Sutton-in-Ashfield.—The contract for the settings of ten beds of eight retorts each, on the Klönne principle, at the Burton-on-Trent Gas-Works, has been placed with Messrs. Graham, Morton, and Co., of Leeds. The firm are also at the present time building a bench of inclined retorts—seven beds of six retorts each—at the Sutton-in-Ashfield Gas-Works, together with the coal-handling plant, consisting of elevators, breaker, conveyors, structural work, &c., in accordance with the specification of Messrs. Corbet Woodall and Son, of London.

EDINBURGH AND LEITH GAS COMMISSION.

The Extra Charge for Prepayment Meters—The Reorganization of the Office Staff.

The Edinburgh and Leith Gas Commissioners held a monthly meeting on Monday of last week, at which Lord Provost BROWN presided.

The Works Committee reported that they had reconsidered the subject of the extra charge to prepayment meter consumers; that the Clerk repeated his opinion that the Commissioners were entitled to charge such consumers for the extra expenses entailed by their meters, beyond ordinary consumers, and read correspondence which he had had with the Town Clerk of Glasgow, showing that the Corporation of Glasgow were in similar circumstances to the Commissioners and held a similar view to that which the Clerk expressed; and that the Committee had, by a majority, adopted the recommendation of the Engineer, to charge at the rate of 1d. per 20 cubic feet, subject to rebates. The recommendation of the Engineer is equal to the rate of 1s. 2d. per 1000 cubic feet; and the two opposing proposals were that the extra charge should be 7d. and 10d. respectively, per 1000 cubic feet.

Judge PENNELL, in the Commission, moved that the extra charge be 7d. Prepayment meters, he said, were only one of a series of appliances belonging to the Gas Commissioners which were made use of by consumers. They had the Stove Department, in which a charge of 10 per cent. was added, to cover the Commissioners' rent. Another was the use of extra meters, for which no additional charge was made. In the case of prepayment meters, it was not 10 per cent. which they added to the cost of the gas, but 38 per cent. They had obtained from various places information as to what was the cost of working prepayment meters; and they had also ascertained that there was, in the case of certain English undertakings, a model clause which allowed an added rate of 10d. They found in seven or eight places the average extra charge was 7d. This was the charge which was made in Glasgow; and he thought it was right that, to this extent, they should relieve those people who paid in advance.

Mr. DOUGLAS ELLIOT seconded. The very object of their existence, he considered, was to see that the whole of the inhabitants could get gas at reasonable prices; and the poorer consumers ought to be supplied on terms as favourable as the larger ones.

Bailie LINDSAY moved that the extra charge be 10d. per 1000 cubic feet. Mr. Herring, he said, had gone very minutely into the matter. The only fault he had to find with his report was that it was written from the standpoint that the Commissioners had for years been not in favour of the prepayment meter system being extended. However unbiassed a gentleman writing a report might be, there was just the possibility that, when writing with a certain end in view, he might put in facts and figures rather to bear out that view. He thought that a charge of 10d. would not lead the Commissioners into any substantial loss. An extra charge of 1s. 2d. seemed to the ordinary lay mind to be a very exorbitant one; and it was difficult for them to explain why it should be so much.

Treasurer CALDER seconded.

Lord Provost BROWN suggested that they might hear Mr. Herring's explanation.

Judge PENNELL said it would be out of order to call in an official to speak to the Commission; and he pointed out that Mr. Herring had reported on the subject.

Judge BRYSON moved approval of the recommendation of the Committee, which was seconded, and on a final vote was adopted by 13 votes to 8.

The Works Committee submitted a long report by a Sub-Committee upon the subject of the reorganization of the office staff, in which it was stated that instructions were given to the Treasurer and the Engineer to report: (1) Their suggestions as to what new appointments should be made for vacancies occurring at Whitsunday next, and in consequence of the probable amalgamation of the offices of Treasurer and collector; (2) as to the holidays allowed to the staff; (3) as to the hours of work of the staff; (4) as to the suggestion that certain of the gas accounts should be paid by cheques sent by the debtors to the office and not handed to the runners; and (lastly) generally as to working out the scheme for organizing the staff.

In the report of the Treasurer (Mr. J. S. Gibb) there was incorporated a statement prepared by the Collector (Mr. R. Cockburn) to the effect that in the year ending May 15, 1890 (being the first complete year of the Commissioners' existence), the number of payments was 215,819, while in the year ending May 15, 1909, the number was 306,663—an increase of 90,844; but that if the prepayment meter payments for 1909 were included, the increase would be 163,323, or 75·768 per cent.

The report of the Engineer (Mr. W. R. Herring) was an interim one. In it he dealt with some proposed changes in the keeping of the meter surveyors' books, and other matters of detail. In conclusion, Mr. Herring said he had endeavoured to keep prominently in view the following factors: First, the efficient administration of the Commissioners' affairs and the economical interest of the undertaking, and that of the gas consuming public as being of primary importance; second, that in any changes in the method of doing the work, or alteration in the duties of members of the staff, not more than a fair day's work should be demanded from any individual person; third, should it be found that, with efficiency, economies could be introduced and the work accomplished with a smaller staff, care must be taken that no hardship was done to members of the staff who had been led to believe that their positions were permanent. The changes that would inevitably result from retirals in the various departments of the Commissioners would, he had little doubt, permit of most, if not all, of the services of those at present in their employ being retained in some or other of the departments of the undertaking. At the conclusion of any reorganization that might take place, the Committee should be empowered to review the present scale of salaries, and adjust them if found necessary.

The Sub-Committee after careful consideration of these reports, agreed: (1) That in order to conform to the spirit of the Provisional Order, all members of the staff should retire at the age of 65, unless

specially retained longer; (2) that the present Treasurer and Collector should remain in service till completion of the next balance-sheet, not later than Aug. 31; (3) that the Treasurer's recommendations as to the present temporary clerks being made permanent should be left over for consideration till a later period; (4) that the holidays of all the staff should be one fortnight, *plus* public holidays; (5) that the office hours should be, all the year round, from nine to five, with one hour off for lunch; (6) that the offices presently held by the Treasurer and Collector should be amalgamated under one official; (7) that the Engineer should have charge of the working department, including the consumers' clerks and meter surveyors; (8) that the Treasurer should have charge of the Financial Department, including the collectors and financial clerks; (9) that the Sub-Committee should consider at a future meeting as to the payment of accounts by cheques sent to the office; and (lastly) that the Engineer should consider and report his views as to adopting the interleaving system for meter-readers' books.

Subsequent to these findings, the Sub-Committee had a further meeting, at which they again took up consideration of the Treasurer's recommendations as to the temporary clerks, and resolved that, pending readjustment of the permanent staff between the Engineer's and the Treasurer's Departments, consideration of this matter might meantime be delayed; and it was also reported that the Engineer having reported as to the impracticability of adopting the interleaving system in connection with the meter-readers' books, the Sub-Committee were satisfied, and approved of the Engineer's proposed change in the method of keeping the meter reading and consumers' ledger records, and in the inclusion of the stove-rental in the gas ledger and the issue of one account for both items.

Judge BRYSON moved approval of the report, which was agreed to unanimously.

HEYWOOD CORPORATION GAS-WORKS.

Mr. Whatmough's Twenty-First Year of Management.

The fourth annual social gathering in connection with the Heywood Corporation Gas-Works was held last Saturday week in the Conservative Club, when about 120 workmen and friends sat down to an excellent tea. As this was the 21st year of Mr. Whatmough's management of the undertaking, he generously defrayed the whole of the expenses.

During the evening, in the course of a short speech, Mr. Whatmough gave some interesting particulars of the progress of the undertaking in the period mentioned. The number of meters and appliances had, he said, increased by over 11,000. The make of gas had gone up from 75,000,000 cubic feet to 135,000,000 feet—an increase of 60,000,000 feet. The price had been reduced, including this year, by just under 1s. per 1000 cubic feet, representing a saving to the consumers of £6000 per annum; £14,000 had been transferred from the profits to the reduction of the rates; and the reserve fund stood higher than it had ever done in the history of the concern. He expressed the opinion that the time had come when the Corporation ought to devote the whole of the surplus profits to the reduction of the debt of the undertaking, as, in view of the severe competition of electricity and power plants, there was not much field for further developments. He thanked the employees for the good feeling exhibited towards him, and the way in which all worked together for the good of the department. Owing to illness, the Chairman (Councillor David Healey, J.P.) was unable to be present; and Mr. Whatmough apologized for his absence.

On behalf of the Committee, Councillor M'Murdo expressed his pleasure at being at the gathering, and agreed with Mr. Whatmough that the profits of the Gas Department should not be handed over to the rates.

A vote of thanks to Mr. and Mrs. Whatmough for their kindness and hospitality was heartily agreed to; and Mr. Whatmough suitably responded.

GAS AND ELECTRIC LIGHTING AT BISHOP'S STORTFORD.

The gas and electric lighting questions have lately been much before the residents of Bishop's Stortford. It may be remembered that a Bill has been promoted to effect an amalgamation of the Bishop's Stortford and several neighbouring Gas Companies, and its scope was fully dealt with in the "JOURNAL" for the 4th ult. (p. 23). The Urban District Council also decided that they would promote a Bill to sanction the purchase by them of the Gas Company's undertaking. This project was, however, rejected by the Council at their meeting on the 11th ult., as recorded in the "JOURNAL" the following Tuesday. The question then arose as to the Council opposing the Company's Bill; and this was considered at a special meeting held on the 27th ult.

The Chairman of the Council (Mr. J. L. Glasscock) presided, and explained that the meeting had been called, pursuant to the provisions of the Borough Funds Acts, for the purpose of taking into consideration a Bill affecting the interests of the inhabitants, and intended to be introduced into Parliament in the ensuing session. It was unnecessary to read the preamble of the Bill; and if the Council believed it to be expedient to oppose the Bill, there were certain resolutions which must be carried. He thought they must have an absolute majority of the whole number of the Council; and the first thing would be for those in favour of the opposition to propose the resolution, and then they would have an opportunity of voting upon it.

The Clerk (Mr. T. Swatheridge) said that the resolution before the Council was as follows: "That, in the judgment of this Council, and in order to protect the interests of the inhabitants of the urban district of Bishop's Stortford, it is expedient for this Council to oppose the Bill intended to be introduced into Parliament in the ensuing session and now submitted to this Council for consideration." He said if this were carried there would be a subsequent resolution.

The Vice-Chairman of the Council (Mr. H. Kent) said that as he moved that the resolution should be submitted to the statutory meeting of the Council, he would propose its adoption. He had no antagonistic feeling towards anyone; but he considered it to be the duty of the Council to oppose the Bill, in order that they might, if possible, obtain some concessions which would be to the benefit of the gas consumers. If he knew that the ratepayers of the town were diametrically opposed to any opposition to the measure, he would fall in with them; but until such an expression of opinion had been given, the Council should, in his opinion, place themselves in a position to oppose. If, after the elections for the new Council in April, there was an understanding that there was to be no opposition to the Bill, it could be dropped. He considered, however, that the existing Council should go forward with it by depositing a petition against the Bill. Mr. Flinn seconded the motion, because he looked upon the question as one for the future. If the new Council wished to take action, they ought to be able to do so. After some discussion, the Chairman said that while he quite admitted there was a great deal of force in Mr. Kent's and Mr. Flinn's arguments—that the subject should be kept alive until the next Council was elected—it seemed a half-hearted policy. It had not been said that there was any particular point the Council wished to go for, but that they should put themselves in a position to allow their successors to oppose the Bill if they wished to do so. He personally could not take this view. He considered it was rather a hazardous policy to act upon; and therefore he could not support any further expenditure in opposing the Bill. On the resolution being put, six members voted for and three against it. The Chairman thereupon announced that, as the statutory number of eight members had failed to vote for the resolution, it fell through.

The Vice-Chairman asked when he could raise the question of representatives of the Council being sent to urge the Herts County Council to oppose the Bill; and on being informed by the Clerk that the following Tuesday would be time enough, he gave notice that he would move to this effect. Accordingly, at the meeting of the Council last Tuesday, at which he presided in the absence of the Chairman through indisposition, he said he did not intend to go into details in reference to the proposal standing in his name. The Chairman had several times stated that whenever he (the Vice-Chairman) had spoken upon the Gas Company's Bill, he had not put his finger upon any particular clause which would be detrimental to the common interests of the town. He had answered the Chairman to the effect that he was opposed to the measure on account of the huge monopoly it would create. He was still of the same opinion; and he felt convinced that the Bill would never have the seal put upon it which many people desired. Although he and his supporters had lost two or three times in reference to the Bill, he was going to propose a resolution which was not likely to entail much expense. They had a County Council which cost them a good deal of money, and there was now an opportunity of making them serve their purpose by asking them to do the work which the District Council seemed unwilling to do in opposing the monopoly which was in their midst. He proposed that the Council should appoint a deputation to wait upon the Herts County Council and request them to oppose the Bill, or get it amended in some of the ways the Council desired. This was his object in moving the resolution. He hoped it would find a seconder. Mr. Flinn seconded the motion; remarking that it required no comment from him. After some discussion, it was carried by four votes to two, and a deputation was thereupon appointed.

At the annual meeting of the Bishop's Stortford Ratepayers' Association on the 24th ult., the Gas Company's Bill was under consideration. The meeting favoured the application by the District Council for an extension of time to enable the town to consider the advisability of proceeding with the Electric Light Order; and it was resolved that a public meeting of the ratepayers should be held on the following Monday. This duly took place; and a resolution was carried by 46 votes to 15, out of an attendance of 90, to urge the Council to proceed with the Electric Lighting Order, and to place themselves in the best position for carrying it out. At the meeting of the Council next day, the question was brought forward and adjourned.

A NEW HOLDER AT SCUNTHORPE.

The completion of a new gasholder at the Scunthorpe Urban District Council's works was celebrated by a dinner at which the members of the Council were entertained by the Contractors, Messrs. C. & W. Walker, of Donnington. The capacity of the holder is 420,000 cubic feet; and the contract price was £4612. Mr. R. J. Milbourne, Assoc. M.Inst.C.E., Engineer to Messrs. Walker, presided at the dinner; the vice-chair being occupied by Mr. T. Sudlow, the Chairman of the Gas Committee. Mr. J. W. Turner, the Gas Manager, presided at a table composed entirely of the employees from the gas-works.

In the course of the toast list, the Chairman proposed "The Town and Trade of Scunthorpe." He remarked that the gas-works were built in 1900; and the undertaking had since made rapid strides, which showed that the town had had a prosperous ten years. It was about twelve months ago when the order was given to his firm to erect the new holder. In responding, Mr. D. Dixon, the Chairman of the Council, said the event they were celebrating that night showed the development of the district. The importance of extending the gas undertaking was very apparent.

Mr. John Long proposed "Success to the Gasholder and the Gas Undertaking;" pointing out that the question of a reduction in price was worth thinking about. The more gas they made, the cheaper they could make it. They had now a plant which did away with Friday and Saturday night fears of not being able to keep the town going. In reply, Mr. Sudlow said that when the Council were considering the provision of a new holder, they decided to go in for one of the newest type, and one which would prove the most serviceable. The work was entrusted to Messrs. Walker; and right from the beginning to the finish, it had gone through without a hitch, and without an accident. The work on the foundations was of a serious character. They had had to put in 2 feet of solid concrete; and as the excavation was 101 ft. 8 in. diameter, it would be seen that there was something to do. This work had been entrusted to a local man, and satisfactorily carried out. He mentioned to Mr. Milbourne, when his firm had secured the contract, the fact that

they had steel works in the locality; and he was pleased to say that a good part of the steel used was the production of the Frodingham Iron and Steel Company. At the Local Government Board inquiry, the Inspector congratulated the Council on beginning these extensions at the right end, and said they were wide awake. The old gasholder was too small. At week-ends there was more gas consumed in one night than filled it. The new holder had a capacity of 420,000 cubic feet; the old one, of 120,000 cubic feet. The gas undertaking was only of recent growth. They commenced in 1901 to manufacture gas, and had 185 consumers; now they had 1400 consumers. When they began, their output was 5 million cubic feet per annum; to-day it was 35 million cubic feet. Recently they had had an inquiry into the question of supplying gas to Crosby, which he hoped would result in powers being granted. This would mean a further demand on their holder. The gas undertaking was a monument of the foresight of the members of the Council. In conclusion, he paid a tribute to the staff at the gas-works.

Other toasts were, "The Gas-Works Staff and Workmen," proposed by Dr. Behrendt, and responded to by Mr. Turner; and "Success to the Firm of Messrs. C. & W. Walker," proposed by Mr. Sudlow, and responded to by Mr. Milbourne, who said his firm had placed as much work as possible in the district. The new holder had been prepared for another lift, which at any time would, at a comparatively small cost, enlarge it to a third more than its present capacity.

EFFECT OF THE PARIS FLOODS ON THE CITY LIGHTING.

Now that the gradual fall of the Seine has brought relief to the thousands who have been affected by its recent overflow, the inhabitants of Paris and its suburbs are beginning to realize how easily, by an abnormal rise in their usually calmly flowing river, they may be deprived not only of light, but of supplies of food by the obstruction or the disorganization of the ordinary means of transport. Fortunately, so far as we have gathered from recent reports, the gas supply has suffered but slightly in comparison with the electric light. This was absent over a wide area of the city on Wednesday night; and next day, according to the Paris Correspondent of the "Daily Telegraph," numbers of workmen were opening streets to get at the electric conduits, and cables were being laid on the surface and over the roofs of houses to carry current to the streets and quarters which had been deprived of it. Other workmen were busy emptying water out of the conduits round gas-mains, and repairing broken pipes. Petroleum lamps were in use in such places as the Champs Elysées and the Quai de l'Archevêché, and gave out a faint glimmer at night, as in country villages. The central boulevards were still without electric light.

From present inconveniences, it may not be out of place to take a glance into the future. According to an instructive statement to the "Matin," M. Millerand, the Minister of Public Works, considers that it is unfair to put the blame for the disaster on the works which render Paris more accessible. He points out that no disaster can be eternally averted; but he says some guarantee must be given that a future catastrophe, should it come, will be less extensive. The bridges were wonderfully solid; but the roads leading to them were submerged. This, says M. Millerand, must be improved. Referring to the telegraph service, he testifies to the excellence of the efforts of the employees; but, despite the marvellous efforts of all, he passed two days of anguish thinking that the Central Office would be unable to work, and Paris be isolated from the rest of the world. Why? Because the electric force indispensable to the apparatus was not safe from an invading flood. He declares that "henceforth no inundation must deprive the capital of the Republic of the telegraph." Gas, electricity, and drains are all together underground, so that an accident to one affects the rest; and they must be separated. A Commission is to study this, and when finished the plan will be submitted to Parliament.

DEMURRAGE CLAIMS BY RAILWAY COMPANIES.

The Committee on Gas Supply of the Glasgow Corporation had recently under consideration the question of demurrage claims by railway companies; and they intimated to the Corporation last Thursday that it had been reported to them by the Town Clerk that application had been made to the Railway and Canal Commissioners by the Coalmasters Associations, traders, and the railway companies, in connection with the question of demurrage charges. The Town Clerk also reported to the Committee that the Engineer to the Edinburgh and Leith Gas Commissioners had been in communication with the Board of Trade as to the position of Scottish municipalities owning gas undertakings, and that the Board had stated that it was quite open to the municipalities to apply on their own part for the appointment of an arbitrator in regard to the charges, and that the award of the Railway and Canal Commissioners in connection with the applications already made would technically apply only to the specific cases submitted for arbitration. The Town Clerk stated that he understood that the Edinburgh and Leith Gas Commissioners were of opinion that joint application on behalf of the municipalities should be made to the Railway and Canal Commissioners prior to their dealing with the other applications, and that they were desirous of again conferring with representatives of the Glasgow Corporation on the subject. The Glasgow Gas Committee, being strongly of opinion that no such application should be made by the municipalities at this stage, and that any action to be taken by them should be delayed until the decisions in the other applications had been given by the Railway and Canal Commissioners, agreed to a representation to this effect being made to the Edinburgh and Leith Gas Commissioners. The Corporation assented to this course.

The Lincoln City Council have resolved to ask the sanction of the Local Government Board to the borrowing of £13,500 for the purpose of constructing a tower and tank in connection with the new water undertaking.

EARLY DAYS OF GAS LIGHTING IN AMERICA.

The first article in the number of our American contemporary "Gas Logic" for the past month bears the title of "Where Gas was First Used;" and the following particulars are given in regard to the early days of the illuminant named in the United States.

The writer of the article begins by pointing out that, like most inventions, gas lighting was not taken seriously. It seemed to the American and European world of 1800 to be on a par with the Laputan's philosopher's scheme for making sunshine out of cucumbers. People were afraid of what was at first called "burning air," and could not be convinced that fire or explosion would not be the inevitable result of its general use. When the first daring New Yorker, Mr. Samuel Leggett, lighted his house, No. 7, Cherry Street, with gas, people stood at a respectful distance. But it does not take long for human nature to get used to novelty. It is somewhat remarkable, considering the difficulties of communication and the meagre resources of a new country, to note that America was but little behind England in the use of gas, and that Newport (R.I.) and Baltimore (Md.) were, with New York, the American cities to lead the procession. The first public street lighting with gas was on Jan. 28, 1807, in Pall Mall; on Dec. 31, 1813, Westminster Bridge was lighted. Baltimore was lighted by gas in 1821. American inventors and experimenters had paralleled those of England and the Continent in the meantime. In America, David Melville, of Newport (R.I.), had in 1806 completed an apparatus by which he lighted his house and the street in front with gas of his own manufacture. On March 18, 1813, he secured a patent, and lighted with the new illuminant mills at Watertown (Mass.) and two mills near Providence.

All this experimenting and demonstration had been closely watched by enterprising Americans. On Dec. 30, 1815, the "American and Commercial Daily Advertiser" (now the Baltimore "American") published a brief and pointed article on gas, calling attention to the facts that Covent Garden Theatre and some London streets were lighted by gas, and that the inventors had offered it eight or ten years earlier to the people of Baltimore, who had laughed at the idea. The following year, gas lights were exhibited in Peale's Museum on North Holliday Street, Baltimore, which is still standing.

In the Baltimore paper already mentioned, on June 13, 1816, this announcement appeared:

GAS LIGHTS

WITHOUT OIL, TALLOW, WICK, OR SMOKE

It is not necessary to invite attention to the gas lights by which my Saloon of Paintings is now illuminated; those who have seen the ring beset with gems of light are sufficiently disposed to spread their reputation. The purpose of this notice is merely to say that the Museum will be illuminated every evening until the public curiosity shall be satisfied.

REMBRANDT PEALE.

When the Museum was discontinued, the building was for some years used as a City Hall, and later for a Public School. It is now occupied by the Baltimore City Water Department. The demonstration by Mr. Peale resulted in the formation of a Company for the manufacture of gas in sufficient quantities to light the entire city; and the Company began operations in 1821.

PUMPING AT THE BRAINTREE WATER-WORKS.

The water-works of the Braintree Urban District Council have been equipped with new pumping machinery; and an official test was carried out a few weeks ago, with satisfactory results. In the course of a report thereon to the Council, Mr. Percy Griffith, M.Inst.C.E., furnishes the following particulars.

A full and constant supply of 15,000 gallons per hour can be obtained with a depth of 40 feet of water in the well; in other words, pumping at this rate does not lower the water-level more than 80 ft. 9 in. from the surface, leaving a reserve of 40 feet depth of water in the well available to cover any falling off in the supply. Increases in demand are fully covered by the fact that by pumping for 24 hours per day the Council now have an available supply of 360,000 gallons, or sufficient for a population of 18,000. Mr. Griffith says the economy of pumping costs estimated by him in his former reports will be fully realized, and, as a result, the capital outlay now incurred will not involve any increased demand on the rates; in other words, the recent alterations and extensions will not cost the ratepayers anything. The Contractors (Messrs. Davey, Paxman, and Co., as regards the engine and producer plant, and Messrs. Glenfield and Kennedy, as regards the pumps and gearing) have fully satisfied Mr. Griffith in all the essential features of the new plant. The guaranteed duty has been exceeded as regards consumption of fuel per unit of horse power developed in the engine and per unit of work done measured in water lifted; the slip of the pumps is less than 4 per cent., which is remarkably low; and the whole plant works smoothly and well under the conditions for which it has been designed.

Mr. Griffith concludes his report by saying that steps have been taken which will, he is confident, prevent any risk of contamination of the well water by surface water. He trusts the Council will at once authorize him to carry out the proposed extension of the tank, and so complete a scheme which he is sure will be found to be a valuable asset to the town. The question of lowering the old pumps in No. 2 well should, he thinks, now be considered. He says it is clear that if these were fixed at the bottom of the well, they could be worked at such a speed as to deliver 15,000 gallons of water per hour, and thus secure considerable economy and convenience in working, and at the same time provide an effective duplication of the pumping plant.

At the Middlesex County Council's gas-meter testing-station at Edmonton, 21,497 meters were tested during the quarter ended Dec. 31; the fees received amounting to £643.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The meeting of the Western District of the Scottish Junior Gas Association in Glasgow to-night was, in point of number, the poorest which has ever faced a Chairman in the West. The subject was "The Chemistry of Coal Gas and the Bye-Products;" and it is one that does not appeal to a very extensive section of the members. It was handled by the author, Mr. D. T. Marwick, who is Chemist at Dawsholm, in a manner appropriate to the occasion—not being of too deep a nature nor too crowded with detail; and it was very cordially received.

At the weekly meeting of the Glasgow Corporation on Thursday, Mr. P. G. Stewart called attention to the action of the Gas Committee in reference to a letter from the Municipal Employers' Association, in which it was pointed out that men not trained as gas-fitters had been engaged by the department to make the connections between the street-mains and the street-lamps and properties. After having heard from the Manager, the Committee recommended that no action be taken in the matter. The gas-works, Mr. Stewart said, were a seething mass of discontent. Owing to a cheeseparing policy, retorts had been allowed to get into disrepair; and men had been discharged to save money. He contended that during the recent fogs the Gas Department, owing to their parsimony, had been responsible for the breakdown in gas-fires. Twenty men had been discharged, and others taken on to do the work cheaper. The latter were paid 22s. and 24s. a week, instead of 34s., which was the former wage. He asked the Convener to take the minute back. The Convener—Mr. M. W. Montgomery—declined. He said he never heard of a single man being dismissed. After some heated remarks by Mr. Stewart, Mr. Montgomery explained that the rearrangement made was simply a reversion to the state of matters during the *régime* of Mr. Foulis. Personally, he was quite willing to receive a deputation of the men. The Committee were anxious to take the men with them. The minutes were adopted by 31 votes to 15. Mr. Moir moved that there be provided in some convenient part of the Municipal Buildings, situated and so arranged as to test the illuminating power of the gas supplied by the Corporation, a photometer with an experimental meter and other necessary apparatus; the burner to be used in connection with the testing to be that known as the "Metropolitan" argand burner No. 2, the photometer to be a bar photometer, and the standard light to be that supplied by Harcourt's 10-candle pentane lamp, and that, in making the test, the burner be so used as to obtain from the gas, when burned at the rate of 5 cubic feet per hour, the greatest amount of light. The motion was defeated by a large majority.

The Edinburgh and Leith Gas Commissioners on Monday got through a more than usually large amount of public business. It will be observed, from a report of the proceedings upon another page, that, though strongly urged to give easier terms to prepayment meter consumers, they adopted the recommendation of the Works Committee, based upon the exhaustive report upon the subject by the Engineer—Mr. W. R. Herring (published in the "JOURNAL" for July 20 last, p. 195)—to continue the differential rate, which is equal to 1s. 2d. per 1000 cubic feet, with rebates. The report upon the reorganization of the office staff is an important document, which is attracting some interest in gas circles, and outside of them, as there is shortly to be faced by the Commissioners the task of filling up the vacancy in the desirable post of Treasurer to the Commission, which will become vacant on Aug. 31, when Mr. J. S. Gibb, the Treasurer, and Mr. R Cockburn, the Collector, retire, and their offices are conjoined. There are also expectations of other posts being open, through the changes in the staff—posts, however, which, in the nature of things, may be expected to be filled up from within, although there can be no certainty upon this point; a popularly elected body being open to influence. There are other changes which are not without interest to the staff, consequent upon the transference to the Engineer's Department of the consumers' clerks and meter-surveying departments. It is satisfactory to note the increased volume of business which is being done—the Engineer's report showing an extra output of gas during December of 26,272,000 cubic feet—equal to 9·89 per cent.; and since May 16 an increase of 81,118,000 cubic feet, or equal to 7·05 per cent.

In the Dysart Town Council on Tuesday, Mr. Gallacher, in terms of notice given, moved that the Council adopt the Burghs Gas Supply Act, with a view to acquiring the gas-works. There were numerous complaints about the exorbitant price charged by the Gas Company; and he believed that the gas would be supplied much cheaper. Treasurer Spalding, while sympathizing with the motion, pointed out that the harbour and three farms which were owned by the Corporation were heavily mortgaged. He thought they should endeavour to redeem some of these mortgages, which were crippling the enterprise of the burgh, before they incurred new burdens. Other gentlemen spoke to the same effect; and no one seconding Mr. Gallacher, his motion fell. In the course of the discussion, it was stated that the Gas Company's dividend was 5 per cent. per annum until a few years ago, when it was raised to 7½ per cent. Another reason for delay, which weighed with some of the councillors, was a desire to see what price will be fixed for the gas-works in the neighbouring and larger town of Kirkcaldy.

In connection with the gas transfer at Kirkcaldy, now in progress, the Gas Committee of the Town Council have unanimously appointed Mr. Arthur Silverthorne as expert on their behalf.

The gas transfer at Carnoustie, which has had a few ups and downs in its early stages, bids fair to proceed now. A special general meeting of the Carnoustie Gaslight Company was held last Saturday to consider and determine as to the offer made by the Town Council to acquire the Company's undertaking under the Burghs Gas Supply Act. Ex-Provost M'Corquodale presided; and it was unanimously agreed to entertain the offer of £21,000 made by the Corporation.

The Inverkeithing Town Council last night again considered the subject of acquiring the gas undertaking. Mr. Gibson moved that a Special Committee be appointed to confer with the Directors of the Gas Company as to the purchase. The Company had offered to sell for £2500; but he did not know that any reply had been sent to the Company, and he did not think that the town had made an offer. The purchase of the gas-works might not be profitable in the meantime; but he considered that the step would be so in the end. The motion was not seconded; and it accordingly fell through.

In the Dundee Town Council on Thursday, the question of the introduction of a high-pressure gas system was discussed at some length. Mr. Paton moved that the matter be sent back to the Gas Committee for further consideration. He said that the system would mean an increased consumption without any increase in the quality of the gas, and it would be detrimental to fittings in old properties. Mr. Graham, in seconding, said he was not satisfied that this was an ideal system. If they put something like a force-pump at the end of a pipe, they were bound to force the gas through the pipe, and it would increase, and not decrease, the bills; and nobody but the Gas Commissioners would benefit. Mr. High moved approval of the recommendation of the Committee. Treasurer Soutar, in seconding, said that this was a technical matter, and if they were to attend to the proper development of the Gas Department from a business standpoint, they must to a very great extent be guided by their expert Engineer, who had this qualification—that hitherto none of the suggestions he had made had turned out anything other than successful. Bailie Macdonald said it was not pressure, but gas, that they wanted. The motion for a recommit was carried by fourteen votes to eleven.

The most amusing instance of the vagaries of electric lighting that has come under my notice occurred during a concert which was being given in the Oddfellows' Hall, in Edinburgh, on Thursday evening. Following upon the address of the Chairman, the first item on the programme was a duet. Scarcely had the Chairman intimated the title of the piece when the electric lights went out, leaving the audience in almost total darkness. Luckily the old gas-fittings had not been removed; and they were resorted to. The fittings were, however, as might be expected, in very bad order; and the concert was carried through under great inconvenience.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia.

LIVERPOOL, *Feb.* 4.

Direct demand from consumers abroad has been rather poor this week, and, as is frequently the case, dealers have been postponing the covering of their requirements till later in the month; so that the tone of the market has hardly been so good. Home consumption, which is an important factor in the spring, has also been delayed by the inclement weather. The closing quotations are barely steady at £11 11s. 3d. to £11 12s. 6d. per ton f.o.b. Hull, £11 13s. 9d. per ton f.o.b. Liverpool, and £11 15s. to £11 16s. 3d. per ton f.o.b. Leith. There is still practically nothing doing for forward delivery; and although prompt value is reported as having been paid for March shipment, buyers decline to operate for the later months at the present level of prices.

Nitrate of Soda.

The position is without change, and the quotations on spot are still given at 9s. 1½d. per cwt. for ordinary, and at 9s. 4½d. for 96 per cent.

Tar Products.

LONDON, *Feb.* 7.

The markets for tar products have been steady throughout the past week. Pitch is very firm, and has slightly improved all round. Creosote is steady, and in some quarters better prices are reported to have been obtained. Benzol is steady, and distillers are not very eager to sell for forward delivery. Toluol and solvent naphtha are in good demand. The improvement in crude carbolic acid has been maintained, and Continental consumers are reported to have paid better prices.

The average values during the week were: Tar, 15s. to 19s. *ex* works. Pitch, London, 31s. 6d.; east coast, 31s. to 31s. 6d.; west coast, 30s. 6d. to 31s. 6d. f.a.s. Mersey ports, 30s. f.o.b. others. Benzol, 90 per cent., casks included, London, 7d. to 7½d.; North, 6½d. to 7d.; 50-90 per cent., casks included, London, 7¼d. to 7¾d.; North, 7¼d. to 7½d. Toluol, casks included, London, 10d.; North, 9½d. to 10d. Crude naphtha, in bulk, London, 4¼d. to 4½d.; North, 4d. to 4¼d.; solvent naphtha, casks included, London, 1s. 1½d. to 1s. 2½d.; North, 1s. to 1s. 1d.; heavy naphtha, casks included, London, 11½d. to 1s.; North, 11d. to 11½d. Creosote, in bulk, London, 2⅝d. to 2¾d.; North, 2d. to 2¼d. Heavy oils, in bulk, 2½d. Carbolic acid, 60 per cent., casks included, east coast, 11½d. to 1s.; west coast, 11¼d. to 1s. Refined naphthalene, £4 10s. to £8 10s.; salts, 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

There has not been nearly so much buying during the past week, although prices have been well maintained all round. To-day the principal London Gas Companies quote £11 12s. 6d. to £11 15s.; and outside makes upon Beckton terms are £11 6s. 3d. to £11 8s. 9d. In Hull, the ordinary makes are £11 12s. 6d.; but for the better qualities higher prices can be obtained. In Liverpool, £11 15s. is asked; and in Middlesbrough, the same price has also been quoted. In Leith, makers are practically out of the market for prompt delivery, and for forward are asking £11 16s. 3d. to £11 17s. 6d.

Herne Bay Urban District Council and the Gas-Burner Bills.—At the meeting of the Herne Bay Urban District Council last Wednesday, the Vice-Chairman (Mr. H. E. Ramsey) stated that he and the Chairman (Mr. N. Roden) had recently attended a conference of local authorities held at the Westminster Palace Hotel on the subject of the Gas Companies (Standard Burner) Bills; and that it had been resolved that these should be opposed, and that the local authorities within the areas affected should petition against them. At the same time, they were not precluded from negotiating and arranging terms with the particular companies operating in their districts. The resolutions passed at the conference were submitted and approved.

COAL TRADE REPORTS.

Northern Coal Trade.

There is now a larger production of coal both in Northumberland and Durham; and though the difficulty of working under the new Act is not entirely removed, the present output is fair, while the shipments on the large contracts are improving. In the steam coal trade, prices are firmer; and for best Northumbrian steams about 11s. 6d. per ton f.o.b. is quoted. Second-class steams are from 10s. to 10s. 3d. per ton; and steam smalls from 5s. 6d. to 6s. 6d. The collieries seem to be gradually starting; and a full output, for a short time at least, seems assured. In the gas coal trade, more of the collieries have restarted; and the production is larger, though not quite at its full extent. Gas coals vary a little more in price. From 11s. to 11s. 9d. per ton f.o.b., according to the quality, is now quoted for the usual classes; and "Wear" specials are priced up to 12s. There are not many contracts now in the market; but the market is more settled than it was, though the ideas of coalowners seem to be to quote more for forward supplies of coal than buyers have been accustomed to pay—the uncertainty as to what may be the additional cost of production under the new method of working, leading to the higher prices quoted. Coke is now a little more plentiful, but steady; and gas coke is somewhat easier at from 13s. 6d. to 13s. 9d. per ton f.o.b. in the Tyne or Wear.

Scotch Coal Trade.

Trade during the week was quiet; shipping being greatly disorganized by the severe weather. In consequence, ell and splint were more plentiful, and prices were easier. There was a good demand for steam coal. The prices were: Ell, 10s. to 11s. per ton f.o.b. Glasgow; splint, 10s. 9d. to 11s.; and steam, 9s. 6d. to 9s. 9d. The shipments for the week amounted to 305,137 tons—an increase of 4478 tons upon the previous week, and of 39,968 tons upon the corresponding week of last year. For the year to date, the total shipments have been 1,014,877 tons—an increase of 173,247 tons upon the corresponding period.

Midland Gas-Coal Outlook.

Under this heading, a writer in the "Liverpool Post" last Tuesday made the following remarks: "It is at present very early to talk about renewal of contracts for gas coal; but this year the negotiations will possibly be commenced much earlier than usual. In fact, it is reported that the Salford Corporation have already asked, in an informal way, for quotations for twelve months from July next. There are also a number of inquiries in the market for summer deliveries on Continental account, for which quotations are being made at 1s. 6d. per ton advance on last year. Collieries, however, are not over-anxious to enter into contract arrangements at present, as the position for export business will to some extent be governed by the settlement of labour troubles in the North. It will be remembered that last year Tyneside collieries secured the bulk of business with the London waterside gas companies, and also the lion's share of Continental orders, on account of the low prices accepted. Should their outputs be seriously affected, or sectional labour trouble be experienced, as seems likely, it is quite possible that a good tonnage will come back to the Midlands. The arrangement of contracts by the large London waterside gas companies is always looked on with great interest. The terms on which they renew are usually taken as a basis for the settlement of contracts in inland towns, as by the alternative methods of transport—by sea from the North-East Coast, direct by rail, or shipped *via* Hull from the North Midlands—they possess a bartering power over the inland towns. It is reported that gas-coal contracts have been renewed by Durham collieries at 2s. per ton advance; so that, as far as can be seen at present, everything points to collieries in the Midlands being able to obtain very substantial advances, and, though it is unsafe to prophesy, it is most likely that no contracts will be renewed at less than 1s. per ton advance. Last year renewals were made at 6d. and 9d. per ton reduction; and it was well known that some of the large tonnage contracts left no distinct margin of profit, so that an advance of only 1s. per ton will make a huge difference to colliery balance-sheets.

Bristol Corporation and the Gas Company's Bill.

The Parliamentary Bills Committee of the Bristol City Council have issued their report upon the Bristol Gas Bill. They say it is proposed that the promoters shall be relieved of their obligation to furnish gas to premises having a supply of electrical energy, or of gas from an installation other than that of the promoters, unless the consumer or the intending consumer will agree to pay a minimum annual sum. The Committee consider that the effect of this provision would be that a supply of gas for (say) cooking or heating might be withheld from a person who made use of electrical energy for illuminating purposes, unless he agreed to pay an annual sum, unreasonable in amount, and exceeding the value of the gas consumed. The promoters also seek power to lay pipes in streets not dedicated to the public, without submitting to the Corporation plans of the proposed work, as they are required to do in the case of other streets, though the former streets would eventually have to be made good by the Corporation and adopted as highways, to be repaired by the inhabitants generally. The Committee are of opinion that some of the financial clauses of the Bill are objectionable, as tending to keep up the price of gas, and that many other clauses would injuriously affect the interests of the Corporation and the gas consumers. Under these circumstances, they have decided, subject to the usual sanction, to present a petition against the Bill, and to take the necessary steps to oppose it in Parliament, unless the promoters will consent to the insertion of such provisions as may appear necessary.

Mr. Francis Chalmers, the Manager of the St. Mary Church Gas-Works of the Torquay Town Council, has reported to the Gas Committee that the methane-hydrogen plant is practically complete, and promises to be a useful addition to the works.

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228.

The Meaning of "Ground Floor."

At the Westminster County Court last Tuesday, several interesting points were raised in an action brought by the Metropolitan Water Board against a Mrs. Lever, of Pemberton Gardens, Upper Holloway, to recover water-rates. The dispute had extended over a considerable period; and the Board admitted that they could not recover the whole of the claim as first made. The defendant counterclaimed for the return of money paid by mistake. Under the Act of the New River Company, the charge for water supplied to cisterns more than 10 feet above the ground floor was higher than that levied when the water was supplied to a lower level; and it was disputed whether in the house in question the cisterns were more than the distance named above the ground floor. It was contended for the Board that this meant the ground; and that though in the premises in question the hall door was on a level with the pavement and the cisterns were not 10 feet above that, yet, the house being on a hill, the basement was, at the back of the house, on a level with the garden, and more than 10 feet below the cisterns, and that the higher charge would therefore be correct. With regard to the counterclaim, the Board contended that the Public Authorities Protection Act, which specified that actions against a public authority not arising from contract must be brought within six months, applied, and that they were not liable. Mr. Gover, for the defendant, contended (1) that the ground floor meant the floor on a level with the hall; (2) that the defendant's counterclaim was not properly an action, but a set-off, or defence; (3) that the Water Board were not in this case a public authority; (4) that if they were, they were not here acting as one, and that the claim arose by contractual relations as between one party and another. His Honour Judge Woodfall held that the words "ground floor" in the Act must be taken to have the generally accepted meaning of the phrase—viz., the "hall floor." He also held that the Board were a public authority, and were acting as one. After argument, judgment was entered for plaintiffs on the claim, with costs.

Municipal Electricity not Wanted at Macclesfield.—Some days ago, the Macclesfield Town Council further discussed the question of an electricity supply for the borough. The Gas Committee had made a recommendation that the Electric Lighting Order which the Corporation at present hold should be retained; and on the instruction of the Council, the Gas Engineer (Mr. William Newbigging) had prepared a report upon the matter, in which he said that a municipal undertaking would entail heavy loss. Discussion took place as to whether the Corporation should retain their Order or abandon it and let a private company supply electricity. Mr. Oldfield moved as an amendment that, in view of the large expenditure to which Macclesfield was already committed, and no demand for the supply of electricity in the borough having been made, the Council decline to exercise their powers of installing a system of electrical supply, but offer every facility for a company to come in and provide such a supply—the Corporation safeguarding the interests of the ratepayers in the usual way. The amendment was carried by 25 votes to 12.

The Dangerous Chandelier Again.

The adjourned inquiry into the cause of death of Annie Pearce (16), who died as the result of burns received at a serious gas explosion at Lydney Park, Gloucestershire, the seat of Mr. Charles Bathurst, M.P., was held last Friday afternoon by Mr. H. Allen Armitage, the Deputy-Coroner. The fatality has already been referred to in the "JOURNAL" (see *ante*, pp. 58, 121). The evidence given by Ernest Bailey (the under-gardener), Rosina Smith (the cook), and Gertrude Jones (the kitchen-maid), all of whom were seriously injured, showed that on the 30th of December an escape of gas having been detected when the servants came downstairs, search was made for it, and it appeared to be in the housemaid's room. The cook suggested that perhaps the chandelier, which was low, had something to do with it, and she pushed it up slowly—the explosion immediately occurring. The place was at once in flames, and much damage was done to the woodwork. Mr. J. Lauder (the steward) said he had had the chandelier, which was one of the old-fashioned rising and falling pendants, examined by a plumber in the presence of the police. His theory was that, the chandelier having been left down extremely low during the whole of the night, gas had gradually escaped, and, the ceiling being high, had accumulated above the level of the door. Thus when the cook lifted the bracket—one jet of which was alight—the explosion was caused. The Jury returned a verdict that the girl died from shock to the system caused by injuries received through the gas explosion at Lydney Park; adding a rider to the effect that precaution should be taken to prevent such an accident happening again by doing away with the present chandelier. Mr. Lauder said this should be done.

Westminster Public Lighting.—The Westminster City Council, in view of the early termination of the present contracts for street lighting with the Gaslight and Coke Company (for low-pressure gas lighting on the 31st prox., and for high-pressure gas lighting on the 31st of December next), have appointed a Sub-Committee to consider the matter and obtain competitive tenders.

Vertical Retorts at St. Helens.—In proposing the adoption by the St. Helens Town Council of the minutes of the Gas Committee, Mr. Grace, the Deputy-Chairman, said they would see that there had been an increased output of 5½ million cubic feet of gas during the month of December; and it was thought wise to decide upon the erection of a further set of vertical retorts. He was sure the Committee and the ratepayers would be glad to know that the results of the brilliant genius of their Gas Engineer (Mr. Samuel Glover) had been received by the gas engineering world with a considerable amount of enthusiasm. They had recently had visits from gas engineers from Japan, America, and other countries to the gas-works to inspect the new installation; and from the experience they had of the working of the vertical retorts, they were looking forward to a considerable reduction of the cost of producing gas.

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Annfield Plain and District Gas Company.—Satisfactory progress has been made with this Company's business, as is shown by the accounts. The receipts for last year were £5563; and the total expenditure on revenue account £3563—leaving a net profit of £2000. The general meeting will take place on the 16th inst., when a dividend at the rate of 5 per cent. will be proposed by the Board.

Gas Poisoning Case at Brighton.—On Saturday, the 29th ult., Mr. Coley Bromfield was found dead in the scullery of his house in Clarence Square, Brighton. His head was in a gas-stove, and the gas was fully turned on. Mrs. Bromfield went to bed at eleven o'clock the previous night, and some time afterwards her husband went to her room and said he had found some valuable papers, and was going downstairs to look them over. He did not return, and when Mrs. Bromfield awoke in the morning she detected a smell of gas. She went downstairs and found her husband lying dead. A doctor was sent for, and efforts were made to restore animation, but without success. At the inquest on Monday last week, Mrs. Bromfield stated that her husband had had financial troubles. The Jury returned a verdict of "Suicide;" leaving the state of his mind an open question.

Gas-Workers' Wages at Blackpool.—Further reference was made at last Tuesday's meeting of the Blackpool Town Council to an agitation by the Corporation gas-workers for better pay and improved conditions of labour. Mr. Cartledge took exception to a resolution notifying the Gas-Workers' Union that this matter was now closed. The Corporation, he said, ought to try and keep on good terms with their employees. He proposed that the question should be further considered, as there was not enough information to put before the Committee. Mr. Ellis said that the agitation was likely to be prosecuted with warmth; and it was better for the Corporation to leave the matter open. In opposing the amendment, Alderman Ward stated that the men were well paid and content, if agitators would only keep away. They merely came to the town, he added, to disturb the men. The amendment to leave the matter open was carried by a large majority.

South Staffordshire Mond Gas Power and Heating Company.—The Directors of this Company report that in the year ended the 31st of December last the number of ordinary customers on the books increased from 84 to 96, and the number supplied from 80 to 90. They state that there have been continued improvements in the working of the plant and the recovery of bye-products. The quantity of gas sold to ordinary customers was 80 per cent. more than in 1908; and the average price realized shows an increase of 21 per cent. The profit on the revenue account is £860. In 1908, the loss was £4851; the difference in the two years being £5711. The Directors consider this progress very satisfactory; and they have no doubt that if trade had not been so depressed during the year, the result would have been still better. They express regret at the death of Dr. Ludwig Mond, F.R.S., who was Vice-Chairman of the Company from its formation. Mr. Robert L. Mond has accepted the vice-chairmanship of the Company. It is not intended to fill the vacancy on the Board; and the Directors suggest that their number should now be reduced.

Corporate Ownership of Water-Works in America.—In the course of an article on "Engineering in the United States in 1909" in the current issue of the "Engineer," the writer, dealing with the subject of water supply, says: "Corporate ownership of water supply is not regarded favourably in America, especially for large cities; and the City of Omaha has voted bonds for £1,300,000 for municipal ownership. The plant of the Company is valued at £1,220,000. San Francisco and Denver are also determined to have municipal ownership, in spite of powerful opposition on the part of the Companies and the financial concerns interested in the latter. . . . On the other hand, financial and political interests have made an attempt to induce the City of Philadelphia to sell its water-works, on the ground that better and cheaper service would be given. Certain local politicians have aided and abetted this idea by political mismanagement of the works; but the project was very quickly defeated."

Public Lighting of Cardiff.—At a special meeting of the Cardiff Electric Lighting and Tramways Committee, a letter was considered from the Cardiff Gas Company offering certain terms for improving the public lighting. The offer was to convert the 1232 flat-flame lamps to the incandescent system, at 15s. per lamp, spread over three years, and to reduce the charge by 3s. 7d. per lamp per annum; or, as an alternative, to supply entirely new lamps at £2 2s. each. For thirty special lamps, they offered to increase the power for £78 per annum for three years, as against the present cost of £120 a year. The Committee inspected several samples of lamps supplied them, and, having had reports from Mr. Harpur, the City Engineer, and Mr. Irwin, the Gas Inspector, the Chairman (Mr. J. W. Courtis) proposed, and Mr. Vivian seconded, that they submit to the Gas Company, as an alternative to their proposal, a certain lantern recommended by the City Engineer, and ask them to quote for that. This was agreed to. The Chairman remarked that they hoped in six months' time to have the whole of the street-lamps converted to the incandescent system.

Leeds Gas Workers' Wages.—The Leeds Gas Committee, reporting to the City Council an application of the employees for an increase of wages of 6d. per shift, recommended that the matter be adjourned until the next monthly meeting, and that in the meantime the General Manager should obtain further information on the subject from other towns. Mr. Brassington complained of the delay which had taken place over this matter. He said it seemed to him that the Gas Committee were afraid of passing any definite resolution on the subject. The plan of instructing the General Manager to obtain information on the question was a most unsatisfactory manner of dealing with it. The Leeds Corporation surely ought not to be guided by what was done in other towns in a matter of this sort, because the conditions of other towns were different. The dispute ought to be settled by the Corporation on its merits. Mr. Badlay remarked that for nearly twenty years the men had not had a rise, except for a copper or two per shift. But the speeding-up of the work and the introduction of machinery had greatly changed the conditions of employment. On behalf of the Committee, it was pointed out that there had been no unnecessary delay; and the minutes were approved.

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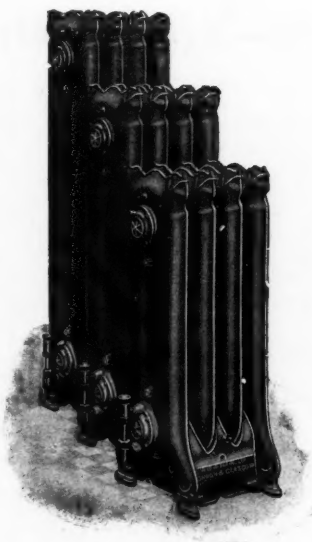

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49, Queen Victoria Street, LONDON, E.C., and Gothic Works, FALKIRK.

Salford and the Supply of Coke by Retail.

At last week's meeting of the Salford Town Council, the question of establishing yards in various parts of the borough for the sale of gas coke was discussed. Alderman Phillips, the Chairman of the Gas Committee, said the matter had been before them on several previous occasions. In 1893, the Council adopted a resolution with the object of increasing the retail sales of coke in the borough. Lurries were engaged, and went through the streets to supply coke to the inhabitants; the scheme being in operation from December, 1893, to April of the following year. During this period, 339 tons were sold. The sales, however, gradually fell away; and as the cost of cartage came to £69, it was decided to discontinue the supply. Some 12,000 tons of coke were sold at the gas-works yearly in small quantities to people who generally took it away in waggons; so that it seemed as though sufficient facilities were already offered. Dealing with the cost of establishing yards as suggested, Alderman Phillips pointed out that it would be impossible to get a yard for less than £10 a year; and, of course, there would be additional expense for alterations. A man would have to be placed in charge of the depôt, and he could not be employed at less than 25s. a week. Then there would be the cartage of the coke. It was the opinion of the Gas Committee that the establishment of coke yards was an impracticable scheme; and it should not be forgotten that there were coal dealers having yards in different parts of the borough who did supply coke now. Still, if the Council desired the Gas Committee to spend £600 to £1000 a year in establishing such a scheme as suggested, they were prepared to go into the matter. No resolution was passed in regard to the subject.

Gas Supply for a Derbyshire Village.—The Matlock Gas Company contemplate the erection of gas-works at Chinley, a district that has developed considerably within the last few years. Negotiations are in progress with landowners for a site; and the scheme includes a supply of gas to the Chinley station of the Midland Railway Company. A meeting is to be held in the village with the object of interesting the residents in the project.

Proposed Gas Supply for Woodhall Spa.—The "Yorkshire Post" reports that at Thursday's meeting of the Woodhall Spa Urban Council, Mr. R. A. Came stated that Mr. T. Marsh, Gas Engineer, of Manchester, had expressed his willingness to find all the money to establish a gas supply for the place. He (Mr. Came) had informed Mr. Marsh that he thought the Council would give him all the assistance in their power, but that they would probably require him to enter into an agreement to sell the concern at a valuation on some future occasion, when the Council's financial position would allow them to purchase. The Clerk (Mr. J. E. Chatterton) said it would be a pity if the Council themselves could not have the benefit. Mr. Came replied that the venture would not pay for several years; and they were fortunate in finding someone to lay out the money. It was decided to invite Mr. Marsh to meet the Council on Thursday.

Conviction of a Gas-Works Clerk.

At the Pontefract Quarter Sessions last Wednesday, George Hepworth, aged 29, recently employed as a clerk at the Pontefract Gas-Works, was charged on three indictments with embezzlement, falsification of accounts, and omission of material particulars from his books, with intent to defraud. Mr. Greene (who prosecuted) elected to proceed on the second count—falsification; and he stated that the evidence would be that the prisoner had been in the habit of receiving moneys from the collector of the slot meters, and had initialled the collector's book as the money was handed over. In the register of cash receipts, Hepworth, two days before the audit, had altered amounts; and when he was told that the Auditors had found certain errors, he absconded, and could not be found until he surrendered a month later. Mr. L. V. Whitaker, the Manager, bore out this statement, and said prisoner's wages were 28s. per week. In cross-examination by Mr. Mellor (who appeared for the defence), he admitted that he had on a few occasions borrowed money for his private needs from the strong-room where Hepworth placed it until it went to the bank; but he had always repaid the exact amount, and it was only a temporary loan. It was not true that he sometimes did not go to the bank because he was not in a fit state to sign the receipts. In answer to further questions, witness said he disagreed with the conclusions arrived at by a Special Sub-Committee of the Corporation, with regard to the administration of the gas-works. He believed the reflections cast upon himself were not justified, and that his own work and duties could not be better performed. In defence, the prisoner denied that he had misappropriated a single penny. He admitted having made the alterations, but without any felonious intent at all. He knew the audit was coming on; and he made the alterations because his book did not tally with the amount which had been handed over. Mr. Mellor commented in very strong terms upon the methods of book-keeping in use by the Pontefract Corporation. After an absence of over an hour, the Jury announced that they could not agree; and after a further attempt they brought in a verdict of "Not guilty." The verdict was received with some applause in court. Mr. Greene, however, said that his instructions were to proceed on the other counts; and on Friday the prisoner was found guilty of omissions from his books with intent to defraud. The Recorder (Mr. R. H. V. Wragge) remarked that the Corporation's book-keeping was admittedly not perfect; and but for the fact that they were simply perpetuating the system which had been in vogue with the old Gas Company, it would have been inexcusable. Of the remarkable series of omissions alleged against the prisoner, there was absolutely no attempt at any explanation. However bad a system might be, no man had a right to take advantage of it to become dishonest. But for the fact that the Corporation did not wish to press the case, he should have felt it his duty to pass a very heavy sentence. Taking everything into consideration, he could not do less than sentence the prisoner to six months' imprisonment in the second division. Mr. Mellor gave notice of appeal on a legal point as to the form in which the indictment had been drawn.

The **RADIATOR** among **RADIATORS** is the

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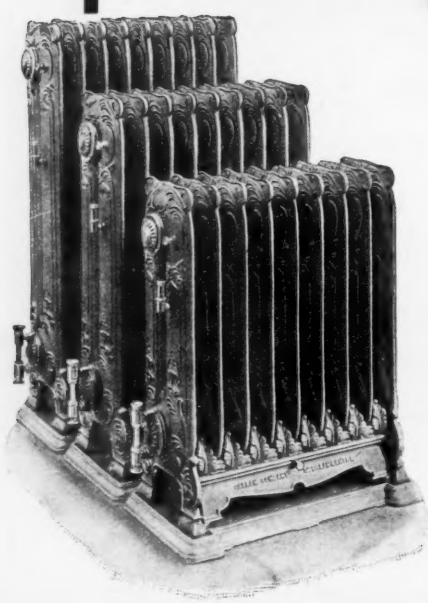
Gas-Heated Steam-Radiator.



AN ATTESTATION.

LLANELLY GASLIGHT COMPANY.

19th January, 1910.

Gentlemen,

In reply to your enquiry as to the Gas Radiators supplied to this Company by you, I have no hesitation in saying that they are the best and most efficient working apparatus of this kind that we have had here. I am very pleased with them.

(signed) THOMAS ACLAND,
Manager and Secretary.

FULL PARTICULARS FROM

Carron Company

INCORPORATED BY ROYAL CHARTER 1773

Works: CARRON, Stirlingshire.

London's Old Water Service.—During the excavations for the new County Hall on the Lambeth side of the Thames, there have been found several of the old wooden ducts which were in use before the introduction of the modern water-mains. They are in an excellent state of preservation, and are similar to those found in Fleet Street some time ago.

Suicide by Gas at Manchester.—A youth named Alfred Wilkinson, residing with his mother in Florence Street, Hightown, Manchester, was found dead in his bedroom last Thursday night, the apartment being full of gas. There was every indication that Wilkinson had deliberately turned on the gas, and had been suffocated by the fumes communicated to him in bed by means of an india-rubber tube fixed to the gas-bracket. At the inquest, when the usual verdict was returned, it was stated that Wilkinson had been out of work for some time, and had been depressed in consequence. He was 19 years of age.

The Transfer of the Prestatyn Gas-Works.—In connection with the taking over of the Prestatyn Gas-Works, upon the terms set forth by the Umpire after the recent arbitration, the Chairman of the Urban District Council (Mr. Parry Williams) last Saturday week entertained the members; and many congratulatory speeches were made. The Umpire's award, it may be remembered, fixed the purchase price at £14,170. The Council have arranged a loan from the Liverpool Corporation of £16,500, at £3 16s. 6d. per cent., and of £2800 for the costs of the Act from the London City and Midland Bank at 1 per cent. above Bank rate, with a maximum of 4 per cent.—the latter to be repaid in five years.

Co-Partnership at Grantham.—At the 71st half-yearly meeting of the Grantham Gas Company, the Directors reported that there was a balance of £3692 to the credit of the profit and loss account. Out of this sum they recommended that £2000 be applied in payment of the maximum dividend of 5 per cent. per annum on the consolidated stock; that a further sum of £500 be placed to the credit of the reserve fund; and that the balance of £1192 be carried forward to the next accounts. The Chairman (Mr. J. G. Thompson), in moving the adoption of the report, said they would agree with him that it was an entirely satisfactory one. They had been able to pay to the employees, under the co-partnership scheme, a bonus of £139 for the half year, and to carry forward a balance of £1192, which was very good, considering the reduction in the price of gas.

Proposed Reconstruction of the Sowerby Bridge Gas-Works.—At the monthly meeting of the Sowerby Bridge District Council last Wednesday, the minutes of a special meeting of the Gas Committee, called to further consider the report and plans presented by a Sub-Committee for the proposed extension and reconstruction of the gas-works, were submitted. The decisions of the Committee were: (1) That the new retort-house be put on the site where the present one is; (2) that mechanical stoking for the new retort-benches be adopted; and (3) that the plans as prepared be accepted as a basis for the new scheme. Mr. J. W. Whiteley moved the adoption of the minutes. Mr. Bates criticized the scheme, characterizing it as too big an undertaking to rush forward, as there would be no opportunity of speaking upon it until the Local Government Board inquiry. The motion was, however, carried; Mr. Bates being the only dissentient.

Birmingham Gas Committee's Visit to Manchester.—Last Saturday week a visit to the Manchester Corporation Gas-Works was paid by members of the Birmingham Gas Committee and officials. Among the visitors were Sir Hallewell Rogers (Chairman of the Gas Committee), Alderman Lloyd, Councillor Toller, Mr. W. Chaney (Engineer-in-Charge of the Nechells works), and Mr. W. Wastell, Assistant Secretary of the Gas Department. They were received by Alderman Gibson (Chairman of the Manchester Gas Committee), Alderman Jennison, Alderman Birkbeck, Councillors Kay, Meadowcroft, and Todd, Mr. F. A. Price (Superintendent), and Mr. J. G. Newbigging (Chief Engineer). From the Town Hall the party went to the gas-works at Rochdale Road, Bradford Road, and Gaythorn. The chief points of interest were the installation of inclined retorts at the Gaythorn works, the new telpher plant for the removal of coke at the Rochdale Road station, and the big gasholder that is being erected at the Bradford Road station. The visitors returned to the Town Hall, where luncheon was served in the Gas Committee's room. The Birmingham party were, it is stated, unstinting in their praise of the Manchester Gas-Works.

Messrs. John Wright and Co., of Essex Works, Birmingham, forward a copy of their latest "Eureka" booklet, which contains (in an attractive form) illustrated particulars of this well-known type of gas-cooker, as well as of the "Sun" boiler and other of the firm's specialities.

The Gas Committee of the Rotherham Town Council have decided to lodge objections to the Dinnington and District Gas Provisional Order, which is to authorize a supply of gas in various parishes, including Maltby, Bramley, and Wickersley. The Town Council also object to the Maltby Gas Bill.

The Paterson Carburetter Syndicate has been registered as a private company with a capital of £10,000, in £1 shares, to purchase or otherwise acquire a certain invention for improvements in or relating to hydrocarbon gas-producers; also to carry on the business of manufacturers and vendors of, and dealers in, carburetters of every description, gas and other engines, &c.

Last Friday week, there was a landslip along the North Road at Hythe, which fractured one of the gas-mains, and resulted in the Gas Company having to cut about 50 yards of main dead; but fortunately no consumers have been deprived of their supply. We learn from Mr. C. E. Rosevear, the Distribution Superintendent, that it is not intended to relay this main yet, "as the whole hill seems to be on the move."

The Liverpool City Council have confirmed a resolution of the Water Committee that the Lord Mayor be requested to invite the Prince of Wales to perform the opening ceremony of the works at Lake Vyrnwy on their completion; that the Committee be authorized to make the necessary arrangements for the ceremony, and for the attendance of the members of the Council on the occasion; and that the expenses in connection with the opening, and the attendance of members and any other persons invited by the Committee, be paid.

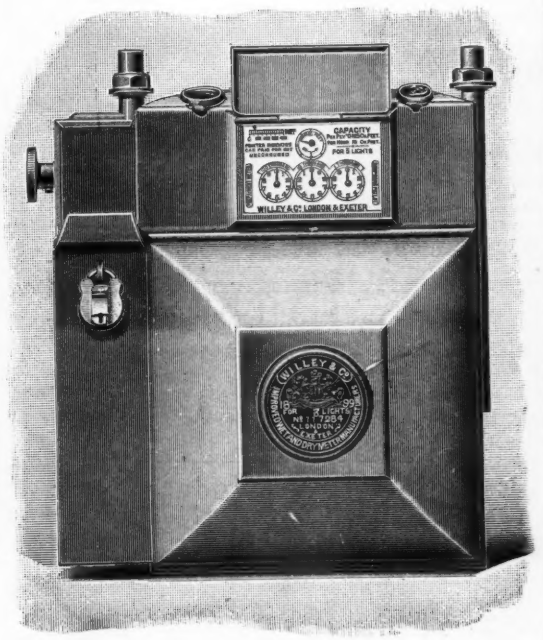
THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price-Changing System is the Simplest, Quickest, and most Accurate yet devised.



ALL PARTS INTERCHANGEABLE.

Tens of Thousands in use, and adopted exclusively by many Gas Companies.

WILLEY & CO., LTD., LONDON & EXETER.

SHOW-ROOMS:

LONDON: 18, Adam Street, Adelphi, W.C.

DEVONPORT: 93, Fore Street.

AGENTS FOR SCOTLAND:

D. M. NELSON & CO., 53, WATERLOO STREET, GLASGOW.

The Rochdale Corporation have decided to proceed with the construction of a new reservoir at Buersil; the estimated cost being £13,000.

From the G. J. Eveson Coal and Coke Company, Limited, of Edmund Street, Birmingham, we have received an attractively bound engagement tear-off diary for 1910. It is of a size which renders it eminently suitable for desk use.

The cause of a gas explosion at Ashton-under-Lyne is reported to have been an escape from the outlet-connection of a gas-meter, which had apparently been melted by a coke-fed stove that was alight in proximity to the cellar in which the meter was placed.

In the course of a discussion in the Wrexham Town Council with regard to the charges for electricity for places of entertainment, Mr. T. B. Taylor said the lighting of the streets of the town for the past few months had been a disgrace. It had been necessary sometimes to strike a match to find one's way home. Mr. Pickvance (the Electrical Engineer) remarked, however, that this was a most unfair statement to make.

In connection with a motion before the Wigan Borough Council—"That the Lighting Committee be instructed to substitute incandescent lights in the public lamps in Woodhouse Lane at once, in place of the present flat-flame burners," Alderman Ashton said incandescent lighting had been largely extended already; and the entire cost had to come out of the current rate. It was not possible to convert all the lights of the town to incandescents in the course of a couple of years. If they did so, they were going to have an extraordinarily big rate. They had had as many as 150 to 200 mantles broken in one night. On Dec. 28, they had 185 mantles destroyed in one night by the severe weather; and they had to be paid for out of revenue. The Lighting Sub-Committee had spent £1940 this year repairing lamps and putting in incandescents. It was, however, always understood that as soon as there was money incandescent lighting would be extended, not only to the Woodhouse Lane district, but to all the important thoroughfares of the town. Not only that, but where they had new lamps in new streets they were placing incandescent lights. In the course of a couple of years, they would not have a place in the town that was not lighted by incandescents.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

DRAUGHTSMAN. No. 5179.
JUNIOR DRAUGHTSMAN. Firth Blakeley, Sons, and Co., Dewsbury.
METER READER AND MAINTENANCE MAN (FOR CANADA). No. 5176.

Situations Wanted.

ASSISTANT-ENGINEER. No. 5177.
LEADBURNER, &c. (SULPHATE PLANT). No. 5178.

Plant, &c. (Second Hand), for Sale.

GASHOLDER, PURIFIERS, &c. Bideford Gas Company.
GASHOLDERS, SCRUBBER, CONDENSER, STATION METER, EXHAUSTER, HYDRAULIC MAIN, PIPES, &c., &c. J. Harper and Co., Willenhall.
PURIFIERS, &c. Tyldesley-with-Shakerley Gas Department. Tenders by March 1.
PURIFIERS, SCRUBBERS, AND CONDENSERS. Edinburgh and Leith Gas Commissioners.
SCRUBBERS, WASHER, STATION METER, &c. Stockport Gas Department.

Plant, &c. (Second-Hand), Wanted.

PURIFIERS, &c. Lothian Coal Company.
PURIFIERS, STATION METER, GOVERNOR, &c. H. Tobey, Malton, Yorks.

Stocks and Shares.

ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY. Feb. 15.
HORNSEY GAS COMPANY. March 1.
NORTH MIDDLESEX GAS COMPANY. Feb. 15.
SOUTH ESSEX WATER COMPANY. March 1.
SOUTHGATE GAS COMPANY. Feb. 15.

Meetings.

BARNET GAS AND WATER COMPANY. Holborn Restaurant, Feb. 28, Three o'clock.
BARNSTAPLE GAS COMPANY. Bridge Hall, Barnstaple, Feb. 19, Twelve o'clock.
BRENTFORD GAS COMPANY. St. Ermin's Hotel, Feb. 11, 2.30 o'clock.
BRIGHTON AND HOVE GAS COMPANY. London Office, Feb. 25, Two o'clock.
BROMLEY AND CRAYS GAS COMPANY. Offices, Feb. 22, Six o'clock.
CHICHESTER GAS COMPANY. Offices, Feb. 25, One o'clock.
ENFIELD GAS COMPANY. Offices, Feb. 24, 5.30 o'clock.
HORNSEY GAS COMPANY. London Office, Feb. 18, 3.30 o'clock.
MITCHAM AND WIMBLEDON GAS COMPANY. Offices, Feb. 22, Three o'clock.
NORTH MIDDLESEX GAS COMPANY. London Office, Feb. 23, 2.30 o'clock.
RIDDINGS DISTRICT GAS COMPANY. London Office, Feb. 28, Four o'clock.
SOUTH SUBURBAN GAS COMPANY. De Keyser's Hotel, Feb. 18, Three o'clock.

TENDERS FOR

Cookers.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 22.

Fire-Clay Goods.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 22.
TODMORDEN GAS DEPARTMENT.

Gasholders (Telescoping).

ABERAVON GAS DEPARTMENT. Tenders by Feb. 14.
BAKEWELL URBAN DISTRICT COUNCIL. Tenders by Feb. 23.

General Stores.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 22.
STOCKTON-ON-TEES CORPORATION. Tenders by Feb. 15.

Meters.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 22.

Pipes, &c.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 22.
TYLDESLEY-WITH-SHAKERLEY GAS DEPARTMENT. Tenders by March 1.

Retort Setting, &c.

TODMORDEN GAS DEPARTMENT.

Sulphuric Acid.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 22.

Tar and Liquor.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 22.
HAWORTH URBAN DISTRICT COUNCIL. Tenders by Feb. 21.
MANCHESTER GAS DEPARTMENT. Tenders by March 23.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 347.

Issue	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,474,000	Stk.	Oct. 14	5	Alliance & Dublin Ord.	86–88	..	5 13 8
310,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
200,000	5	Oct. 28	6¼	Bombay, Ltd.	5⅞–6⅛	..	5 6 1
40,000	5	,,	6¼	Do. New, £4 paid	4⅜–4⅝	..	5 6 8
50,000	10	Aug. 26	15	Bourne-mouth Gas and Water Pref. 6 p.c.	10 p.c. 28½–29	..	5 3 5
311,810	10	,,	7		B 7 p.c. 16½–16⅝	..	4 3 7
75,000	10	,,	6		15⅜–15⅝	..	3 16 2
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	254–257	+1	4 17 3
300,000	,,	,,	9¾	Do. New	192–194	+1	4 17 11
50,000	,,	,,	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
206,250	,,	Dec. 29	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
220,000	Stk.	Sep. 10	11	Brighton & Hove Orig.	218–221	..	4 19 7
246,320	,,	,,	8	Do. A Ord. Stk.	154–157	..	5 1 11
460,000	20	Oct. 14	10	British	42¾–43¼	..	4 11 11
109,000	Stk.	Aug. 26	6	Bromley, A 5 p.c.	119–121	+1	4 19 2
165,700	,,	,,	4½	Do. B 3½ p.c.	89–91	+1	4 18 11
82,278	,,	,,	5½	Do. C 5 p.c.	106–108	..	5 1 10
55,000	,,	Dec. 29	3½	Do. 3½ p.c. Deb.	87–89	..	3 18 8
500,000	10	Oct. 14	7	Buenos Ayres (New) Ltd.	14⅛–14⅜	..	4 14 11
250,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
100,000	10	—	—	Cape Town & Dis., Ltd.	3–4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	5⅛–5⅜	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	48–49	..	6 2 6
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	80–82	..	5 9 9
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	108½–110½	..	4 10 6
1,493,280	Stk.	Aug. 26	5⅛	Commercial 4 p.c. Stk.	109–111	..	4 13 8
560,000	,,	,,	5	Do. 3½ p.c. do.	105–107	+1	4 13 6
475,000	,,	Dec. 29	3	Do. 3 p.c. Deb. Stk.	81–83	..	3 12 3
800 000	Stk.	Dec. 10	5	Continental Union, Ltd.	95–97	..	5 3 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	137–139	..	5 0 9
492,270	Stk.	—	5	Derby Con. Stk.	121–123	..	4 1 4
55,000	,,	—	4	Do. Deb. Stk.	103–105	..	3 16 2
148,995	,,	Oct. 2	5	East Hull 5 p.c. Ord.	98–100	..	5 0 0
486,090	10	Jan. 27	12	European, Ltd.	24–24¼*	..	4 18 0
354,060	10	,,	12	Do. £7 10s. paid.	18½–18¾*	..	4 16 0
15,141,545	Stk.	Aug. 12	4⅝	Gas light and Coke	4 p.c. Ord. 105½–106½	+½	4 7 7
2,600,000	,,	,,	3⅜		3½ p.c. max. 88½–89¼	..	3 18 3
3,799,735	,,	,,	4		4 p.c. Con. Pref. 104–105	+⅓	3 16 2
4,193,975	,,	Dec. 29	3		3 p.c. Con. Deb. 81–83	..	3 12 3
258,740	Stk.	Sep. 10	5	Hastings & St. L. 3½ p.c.	95–97	+1	5 3 1
82,500	,,	,,	6¼	Do. do. 5 p.c.	119–121	+1	5 7 5
70,000	10	Sep. 29	11	Hongkong & China, Ltd.	17⅝–18	..	6 2 3
131,030	Stk.	Sep. 10	6¼	Ilford A and C	144–146	..	4 9 0
65,783	,,	,,	5	Do. B	108–110	..	4 10 11
65,500	,,	Dec. 29	4	Do. 4 p.c. Deb.	100–102	..	3 18 5

Issue	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	8	Imperial Continental	175–177	..	4 10 5
1,235,000	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	94–96	..	3 12 11
195,242	Stk.	Aug. 26	6	Lea Bridge Ord, 5 p.c.	120–122	+1	4 18 4
561,000	Stk.	,,	10	Liverpool United A.	227–229	..	4 7 4
718,100	,,	,,	7	Do. B	167–169	..	4 2 10
306,083	,,	Dec. 29	4	Do. Deb. Stk.	103–105	..	3 16 2
75,000	5	Nov. 26	6	Malta & Mediterranean.	4¾–5	..	6 0 0
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	99–102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	Nov. 11	3⅜	Monte Video, Ltd.	12⅝–13⅛	+⅛	5 5 8
1,775,892	Stk.	July 29	4½	Newc'tle & G'tesh'd Con.	107½–108½	+⅜	4 2 11
518,795	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	91–93	..	3 15 3
55,940	10	Aug. 26	7	North Middlesex 7 p.c.	13–13½	..	5 3 8
300,000	Stk.	Nov. 26	8	Oriental, Ltd.	138–140	+1	5 14 4
60,000	5	Sep. 10	8	Ottoman, Ltd.	6⅛–6⅜	..	6 5 6
31,800	53	Aug. 26	13	Portsea Island A.	137–139	..	4 19 0
60,000	50	,,	13	Do. B.	129–131	..	4 19 3
100,000	50	,,	12	Do. C.	122–124	..	4 16 0
114,800	50	,,	10	Do. D and E.	102–104	..	4 16 2
398,490	5	Oct. 28	7	Primitiva Ord.	7⅛–7⅜	..	4 14 11
796,980	5	Jan. 27	5	Do. 5 p.c. Pref.	5⅛–5⅜*	+⅛	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
1,000,000	10	Oct. 14	8	River Plate Ord.	17–17⅛	..	4 11 5
312,650	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	99–101	+1	3 19 3
250,000	10	Sep. 29	8	San Paulo, Ltd.	14⅜–15⅛	+¼	5 4 11
62,500	10	,,	6	Do. 6 p.c. Pref.	11⅜–12¼	..	4 18 0
125,000	50	Jan. 3	5	Do. 5 p.c. Deb.	50–51	..	4 18 0
135,000	Stk.	Sep. 10	10	Sheffield A	233–235	..	4 5 1
209,984	,,	,,	10	Do. B	233–235	..	4 5 1
523,500	,,	,,	10	Do. C	233–235	..	4 5 1
70,000	10	Oct. 14	10	South African	12⅛–12⅜	..	7 16 11
6,429,895	Stk.	Aug. 12	5⅛	South Met., 4 p.c. Ord.	121–123	+½	4 6 8
1,895,445	,,	Jan. 13	3	Do. 3 p.c. Deb.	81–83	..	3 12 3
209,820	Stk.	Aug. 26	8	South Shields Con. Stk.	160–162	..	4 18 9
605,000	Stk.	Aug. 12	5⅛	S'th Suburb'n Ord. 5 p.c.	120–122	..	4 10 2
60,000	,,	,,	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
117,058	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	120–122	..	4 2 0
502,310	Stk.	Nov. 11	5	Southampton Ord.	110–112	..	4 9 3
120,000	Stk.	Aug. 12	6⅞	Tottenham A 5 p.c.	135–137	+1	5 0 3
453,940	,,	,,	5⅜	and B 3½ p.c.	112–114	..	4 14 7
149,470	,,	Dec. 29	4	Edmonton 4 p.c. Deb.	98–100	..	4 0 0
182,380	10	Dec. 29	8	Tuscan, Ltd.	9⅛–9⅜	..	8 4 2
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	99–101	..	4 19 2
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p c max.	112–114	..	4 7 9
255,636	Stk.	Aug. 26	6⅜	Wands- B 3½ p.c.	142–144	+3	4 12 0
79,416	,,	Dec. 29	3	worth 3p.c. Deb. Stk.	74–76	+1	3 18 11

Prices marked * are "Ex div."

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."
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All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

AMMONIACAL Liquor wanted.
CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.
Telegrams: "CHEMICALS."

LUX'S GAS PURIFYING MASS.
See Advertisement on p. 386.
FRIEDRICH LUX, LUDWIGSHAFEN-AM-RHEIN.

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

KRAMERS AND AARTS WATER-GAS PLANT.
K. & A. WATER-GAS COMPANY, LTD.
89, VICTORIA STREET, S.W.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the enrichment of Gas.
Manufactured and supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agent, F. J. NICOL, Pilgrim House, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers, Works: BIRMINGHAM, LEEDS, WAKEFIELD, and SUNDERLAND.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0843.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams:—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

OXIDE OF IRON (BOG ORE).
ANY QUANTITY. ANY PORT. ANY STATION.
DONALD M'INTOSH,
110, CANNON STREET, LONDON.

BENZOL
AND
CARBURINE FOR GAS ENRICHING.
ALSO
THE MAXIM PATENT CARBURETTOR.
For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.,
7, BISHOPSGATE STREET WITHOUT,
LONDON, E.C.
Telegraphic Address: "Carburine, London."

EDGAR OF HAMMERSMITH
FOR
AUTOMATIC GAS FLASHING SIGNS.
BLENHEIM WORKS, LONDON, W.
Telegrams: "GASOSO LONDON." Telephone: 14 HAMMERSMITH.

BROTHERTON & CO., LIMITED.
Offices: City Chambers, LEEDS.
Correspondence invited.

J. E. C. LORD, Ship Canal Tar Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

METER INDICES
WITH AND WITHOUT DIALS.
A. ROUX & CO., Limited,
9, SOUTHAMPTON STREET, HOLBORN, W.C.
MOVEMENTS FOR CLOCKS, PHOTOMETERS AND BAROGRAPHS, WHEELS, PINIONS, AND WORMS.
WORKS, HANDSWORTH, BIRMINGHAM.

SULPHURIC ACID.
SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

GEO. NEWTON, Limited,
Wires: "AUTOMATIC, MANCHESTER."
40 YEARS' REPUTATION.
WET, DRY, ORDINARY and PREPAYMENT, STATION METERS, &c.
Late of Oldham—Note *new* Address:—
39, RIVER STREET, HULME, MANCHESTER.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

OXIDE OF IRON.
(NATURAL.)
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.
BALE & CHURCH,
5, CROOKED LANE, LONDON, E.C.

SULPHURIC ACID.
SPECIALLY prepared for the Manu- facture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341 AVENUE.

BRISTOL RECORDING GAUGES AND THERMOMETERS.
J. W. & C. J. PHILLIPS, 23, COLLEGE HILL LONDON, E.C., and 25, BRIDGE END, LEEDS.

AMMONIA.
Consumers in any form are invited to correspond with CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Thornhill, DEWSBURY.

TAR WANTED.
Telephone: Central Manchester, 7002.
Telegrams: "UPRIGHT."
Apply, THOMAS HORROCKS,
Albert Chemical Works, BRADFORD, MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

R. & G. HISLOP,
GAS ENGINEERS, RETORT BUILDERS, CONTRACTORS, &c.
RETORT SETTINGS, COAL-TESTING PLANT, BOILER FIRING.
UNDERWOOD HOUSE, PAISLEY.

SPENCER'S PATENT HURDLE GRIDS.
THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Feb. 1, p. 277.

"V.S.C." PAINT FOR GAS-WORKS PLANT.
JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
Telegrams: "ENAMEL." National Telephone 1759.

ROBERT DEMPSTER & SONS, Ltd.,
Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Ross Mount Iron-Works, Elland.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.: "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 248 Holborn

SATURATORS, &c., every Description
Made or Repaired on Shortest Notice by a qualified Journeyman Leadburner of long standing. Worked at Beckton and the largest Firms. Own Plant. Distance no object. Workmanship guaranteed.
Address No. 5178, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

GAS-WORKS requiring Extensions
should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results. the *best*. Satisfaction Guaranteed.

APPLICATIONS FOR APPOINTMENTS.
DO you appreciate how much success
depends on well-considered and lucid presentment of your qualifications? I make a Specialty of the Preparation of Applications, and am continually receiving complimentary letters from clients. Write now for Particulars.
Herbert Greatorex, Hackney, Matlock.

ASSISTANT-ENGINEER and Manager,
Excellent Qualifications, Works and Districts, SEEKS VACANCY in medium sized Works.
Address No. 5177, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Good Junior Draughtsman used to Gasholders and Gas Plant.
Apply, stating Experience, and Salary required, to Firth Blakeley, Sons, and Co., Limited, Gas Engineers, Thornhill, Dewsbury.

DRAUGHTSMAN Wanted in a Contractor's Office at once. Must have Experience in Modern Retort Work and Mountings.
Apply, by letter, stating Age, Experience, and Salary required, to No. 5179, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Meter Reader and Maintenance Man for Gas-Works in Western Canada. Must be of Good Appearance and Address Starting Salary, $55 per Month, with One Year's Engagement and Transportation.
Apply, by letter, with References and Testimonials, to No. 5176, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, Four Good, Second-Hand
PURIFIERS, 10 feet Square, with Valve and Connections.
Apply to the Lothian Coal Company, Limited, Newtongrange, Midlothian.

SECOND-HAND Plant wanted—
Two PURIFIERS, either 6 feet or 5 feet square.
STATION METER for 2000 feet per hour.
STATION GOVERNOR for 3000 feet per hour.
VALVES and CONNECTIONS for above.
The Plant must be in good, sound Condition.
Address Mr. Henry Tobey, 19, The Mount, Malton Yorks.

GASHOLDERS - Splendid 45 feet diameter and New STEEL TANK, fixed Complete to Plan and Specification; also 14 feet and 16 feet Diameter GASHOLDERS, with STEEL TANKS. Can be seen temporarily erected. Re-erected Cheap for immediate Sale.
Firth Blakeleys, Thornhill, Dewsbury.

GAS PLANT FOR SALE.
FOUR Cast-Iron Purifiers 8 ft. by 4 ft.
by 3 ft. 6 in. deep, with Covers and Two Layers of Wood Grids. Centre-Valve, 6-inch Connections. Newly erected Three Years ago.
SCRUBBER, Vertical, 16 ft. to 18 ft. high by 2 ft. 6 in. to 2 ft. 9 in. diameter complete, fitted with new Elm Grids.
CONDENSER with Vertical Pipes.
Round STATION METER, with 6 Dial Index. Capacity 3500 Cubic Feet per hour. New Drum. In First-Class Order. Complete with Bye-Pass and all necessary Valves coupled to 6-inch. Main.
Also Two 6-inch Bye-Pass PLUG COCKS (new Three Years ago) for Two extra Purifiers.
EXHAUSTER for same, Belt Driven.
HYDRAULIC MAIN, ASCENSION PIPES, and Six Tangye's Patent MOUTHPIECES, all complete with Connecting Pipes, with all details.
Two GASHOLDERS—One with Standards, 15 ft. diameter by 12 ft. high approx.; one with Ashmore and Pease Chain balanced 13 ft. by 15 ft. approx.
Only just ceased work.
Address John Harper and Co., Limited, Albion Works, Willenhall, Staffs.

CAST-IRON Pipes. Spigot and Socket
or Flanged. Special Quality—9 feet or 12 feet Lengths. When buying, Write us.
A. Lowcock, Limited, Shrewsbury.

BIDEFORD GAS AND COKE COMPANY, LIMITED.

OLD Material for Sale:
10,000 feet HOLDER and Four CAST-IRON PILLARS.
Four CAST-IRON PURIFIERS, and SHEET-IRON COVERS, each 11 ft. 6 in. by 11 ft. 6 in. by 4 ft., with Inlet and Outlet Pipes and Cockey's Valve.
All above ground. To be taken as now standing at the Gas-Works, Bideford.

W. D. Joce,
Secretary.

COUNTY BOROUGH OF STOCKPORT.
(Gas Department.)

FIRST-CLASS SECOND-HAND PLANT.

THE Committee have for Sale the following PLANT, together with all Accessories, &c., for which they are prepared to receive OFFERS:
Two TOWER SCRUBBERS, 30 feet high by 10 feet diameter, with 16-inch Connections.
One STATION METER, capacity 40,000 Cubic Feet per hour, with 16-inch Connections.
One Kirkham, Hulett, and Chandler's "STANDARD" WASHER, capacity 800,000 Cubic Feet per Day, with 16-inch Connections.
The Plant may be Inspected and further Information obtained by Applying to Mr. S. Meunier, Engineer and Manager, Gas-Works, Portwood Stockport.
Offers, endorsed "Second-Hand Plant," to be sent to the Chairman, Gas Committee, Town Clerk's Office, Town Hall, Stockport.

Robert Hyde,
Town Clerk.

Town Hall, Stockport,
Feb. 2, 1910.

EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS.

FIRST-CLASS SECOND-HAND PLANT.

THE Commissioners have for Sale the following PLANT, together with all Accessories, &c., for which they are prepared to receive OFFERS.
Two Sets of WATER-LUTE PURIFIERS, 24 feet by 19 feet.
One Set of WATER-LUTE PURIFIERS, 27 ft. 6 in by 24 ft.
Two TOWER SCRUBBERS, each 60 feet High by 13 feet Diameter.
One Battery of WROUGHT-IRON ANNULAR CONDENSERS, 31 ft. 6 in. high. Inner Tube, 22 inches Diameter.
Detailed Specifications and Drawings can be supplied to Persons contemplating the Purchase of this Plant, and references given to other Works where similar Plant has been transferred.
For further Particulars and full Information, Apply to the undersigned.

W. R. Herring,
General Manager.

Calton Hill, Edinburgh,
Jan. 21, 1910.

URBAN DISTRICT COUNCIL OF TYLDESLEY WITH SHAKERLEY.

SECOND-HAND PURIFIERS.

THE Gas Committee have for Disposal
Two Water-Lute PURIFIERS, 18 ft. square by 5 ft. deep, with 18-inch Connections and Lifting Gear.
Tenders, endorsed "Purifiers," to be delivered to W. J. Matthews, Esq., Clerk to the Council, Tyldesley, on or before March 1, 1910.
The Purifiers may be viewed, and further Particulars obtained, on Application to

H. R. S. Williams,
Gas and Water Manager.

Gas-Works, Tyldesley.

BOROUGH OF BARROW-IN-FURNESS.

THE Corporation are prepared to receive TENDERS for the Purchase of Surplus GAS TAR and OIL-GAS TAR, produced at their Gas-Works from the 1st day of April next to the 31st day of March, 1911, delivered into the Purchaser's Tank-Waggons at the Gas-Works Siding.
Any further Information may be had on Application to the Manager of the Gas-Works.
Sealed Tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Tar," to be delivered at the Town Clerk's Office on or before Tuesday, the 22nd day of February, 1910.
The highest or any Tender not necessarily accepted.

By order,
L. Hewlett,
Town Clerk.

Town Hall, Barrow-in-Furness.

THE Corporation are prepared to receive TENDERS for the Supply of FIRE-BRICKS, CAST-IRON PIPES, WROUGHT-IRON TUBES and FITTINGS, BRASS COCKS, GAS-METERS, GAS-COOKERS, OIL, LIME, IRONMONGERY, and SULPHURIC ACID, as may be required from the 1st day of April next to the 31st day of March, 1911.
Sealed Tenders, on Forms to be obtained at the Office of the Manager of the Gas and Water Works, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Stores," to be delivered at the Town Clerk's Office on or before Tuesday, the 22nd of February, 1910.
The lowest or any Tender not necessarily accepted.

By order,
L. Hewlett,
Town Clerk.

Town Hall, Barrow-in-Furness.

THE Haworth Urban District Council are prepared to receive TENDERS for the Purchase of their Surplus TAR and LIQUOR for the Year ending March 31, 1911.
Tenders to be sent to me, endorsed "Tender for Tar and Liquor," not later than Feb. 21.

William Robertshaw,
Clerk.

Burlington Chambers,
North Street, Keighley.

BAKEWELL URBAN DISTRICT COUNCIL.

TENDERS for the Telescoping of a GASHOLDER are invited.
Particulars and Specifications may be obtained, and Plans Inspected, on Application to the Gas Manager, T. W. Tiplady, Bakewell.
Sealed Tenders, endorsed "Gasholder," must be sent to the undersigned not later than Feb. 23, 1910.
The Council do not bind themselves to accept the lowest or any Tender.

V. R. Cockerton,
Clerk to the Council.

Bakewell.

TODMORDEN CORPORATION.
(Gas Department.)

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the RETORT SETTING, together with the Supply of RETORTS, FIRE-BRICKS, &c., required at their Gas-Works, Millwood, Todmorden, during the Year ending Dec. 31, 1910.
Full Particulars and Form of Tender may be had on Application to the undersigned.

Henry Talbot,
Engineer and Manager.

Gas-Works, Todmorden,
Jan. 31, 1910.

URBAN DISTRICT COUNCIL OF TYLDESLEY WITH SHAKERLEY.

6-INCH MAIN PIPES.

THE Gas Committee are prepared to receive TENDERS for the Supply of about 1000 Yards of 6-inch PIPE, to be delivered during June or July, either on the Chaddock Lane Siding of the Tyldesley Coal Company, or at the Astley Wharf on the Bridgwater Canal.
Tenders, endorsed "Pipes," to be delivered to W. J. Matthews, Esq., Clerk to the Council, Tyldesley, on or before March 1, 1910
Any further Information on Application to

H. R. S. Williams,
Gas and Water Manager.

Gas-Works, Tyldesley.

BOROUGH OF ABERAVON.

THE Gas Committee invite Tenders for TELESCOPING a GASHOLDER, by the Addition of an Outer Lift 82 feet Diameter, together with the necessary Guide Framing, &c.
Plans and Specification of the work may be seen at the office of the undersigned.
Tenders, addressed to M. Tennant, Esq., Town Clerk, and endorsed, "Tender for Telescoping Gasholder," to be received not later than Feb. 14, 1910.
The lowest or any Tender will not necessarily be accepted.

A. J. Bond,
Engineer and Manager.

Gas-Works Office,
Aberavon, Port Talbot,
Feb. 1, 1910.

BOROUGH OF STOCKTON-ON-TEES.

ANNUAL SUPPLIES.

THE District Fund, Gas, and Electricity Committees of the Stockton-on-Tees Corporation invite TENDERS for the Several ARTICLES and STORES required by them for the Year ending the 31st of March, 1911.
Forms of Tender, Conditions of Contract, and all Information, may be obtained of the Borough Surveyor, Gas Manager, and Electrical Engineer.
Persons desirous of Tendering should State the Articles they desire to Offer.
Tenders, endorsed "Stores," and also marked for the particular Committee for which they are intended, on Printed Forms only, to be delivered to me not later than the 15th of February, 1910.
The lowest or any Tender not necessarily accepted, and no Guarantee will be given as to quantity required.

By order,
Arthur B. Crosby.
Town Clerk.

Stockton-on-Tees,
January, 1910.

MANCHESTER CORPORATION GAS-WORKS.

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the Corporation of Manchester are prepared to receive TENDERS for the Purchase and Removal, on the Sliding-Scale Basis, of the COAL GAS TAR to be produced at their Bradford Road Station during a period of One, Two, or Three Years, commencing at noon on the 31st of March, 1910.
Full Particulars and Tender Form may be obtained on written Application to Mr. Fredk. A Price, Superintendent of the Department.
Sealed Tenders, addressed to the Chairman of the Gas Committee and endorsed "Tender for Coal-Gas Tar, Bradford Road," must be delivered at the Offices of the Gas Department, Town Hall, Manchester, before Ten a.m. on Wednesday, the 23rd day of March, 1910.
The Committee do not bind themselves to accept any Tender, and reserve the right to divide any Offer as they may deem advisable.

By order,
Wm. Henry Talbot,
Town Clerk.

Town Hall, Manchester,
Feb. 4, 1910.

BRENTFORD GAS COMPANY.

NOTICE is Hereby Given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at St. Ermin's Hotel, Caxton Street, Westminster, on Friday, the 11th of February next, at Half-past Two o'clock precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending the 31st day of December last, and to elect Directors and Auditors in the place of those who will at such Meeting go out of Office in compliance with the Company's Acts of Parliament.

By order,
WILLIAM MANN,
Secretary.

Office, Brentford,
Jan. 25, 1910.

SOUTH SUBURBAN GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the De Keyser's Royal Hotel, Victoria Embankment, London, E.C., on Friday, the 18th day of February, 1910, at Three o'clock in the Afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended the 31st of December last; to declare a Dividend for the same period; to elect Two Directors and One Auditor in the place of those retiring by rotation; and for General Purposes.

The TRANSFER BOOKS WILL BE CLOSED from the 4th day of February, until after the Meeting.

By order of the Board,
CHARLES M. OHREN,
Secretary.

Offices and Works:
Lower Sydenham, S.E.,
Feb. 1, 1910.

NORTH MIDDLESEX GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Company will be held at the Company's Offices, No. 5, Great Winchester Street, Old Broad Street, in the City of London, on Wednesday, the 23rd day of February inst., at Half-past Two o'clock p.m., to receive the Report of the Directors and the Accounts of the Company for the Half Year ended the 31st of December, 1909; to declare Dividends; to elect a Director and an Auditor; and for other Purposes.

The TRANSFER BOOKS of the Company WILL BE CLOSED from the 10th to the 23rd of February, both days inclusive.

ERNEST L. BURTON,
Secretary.

Secretary's Office: 5, Great Winchester Street,
Old Broad Street, London, E.C.,
Feb. 4, 1910.

BARNSTAPLE GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY GENERAL MEETING of the Shareholders of the above Company will be held at the Bridge Hall, Barnstaple, on Saturday, the 19th day of February, 1910, at Twelve o'clock noon, to receive the Report of the Directors and the Accounts for the Year ended the 31st day of December last; to declare Dividends; to elect a Director and an Auditor; and to transact any other Ordinary Business of the Company.

The TRANSFER BOOKS WILL BE CLOSED from the 6th to the 19th of February, 1910, inclusive.

By order,
F. L. SCHOFIELD,
Secretary.

Offices: 15, Cross Street, Barnstaple,
Jan. 17, 1910.

CITY OF CHICHESTER GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY MEETING of the Proprietors of the above Company will be held at the Offices of the Company, at the Gas-Works, Chichester, on Friday, the 25th day of February, 1910, at One o'clock in the Afternoon precisely, to receive the report of the Directors and the Accounts for the Half Year ended the 31st of December, 1909; to declare a Dividend; to elect a Director and an Auditor; and to Transact the General Business of the Company.

The TRANSFER BOOKS WILL BE CLOSED from the 12th to the 25th of February, both inclusive.

By order of the Board,
VICTOR V. VICK,
Secretary.

Offices: Gas-Works, Chichester,
Feb. 1, 1910.

MITCHAM AND WIMBLEDON DISTRICT GASLIGHT COMPANY.

(INCORPORATED BY ACTS OF PARLIAMENT, 1867 AND 1907.)

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Offices of the Company, Western Road, Mitcham, in the County of Surrey, on Tuesday, the 22nd day of February, 1910, at Three o'clock in the Afternoon precisely, to receive the Report of the Directors and a Statement of Accounts for the Half Year ended the 31st day of December last; to declare a Dividend; to elect two Directors and an Auditor in place of those retiring by rotation; and for General Business.

The TRANSFER BOOKS WILL BE CLOSED from the 7th inst. until after the Meeting.

NOTICE IS HEREBY FURTHER GIVEN, that an EXTRAORDINARY GENERAL MEETING of the Proprietors of this Company will be held immediately after the Ordinary Meeting, for the purpose of authorizing the Creation and Issue, on or after the 1st of July next, of £50,000 CONSOLIDATED ORDINARY STOCK, and the Issue of DEBENTURE BONDS to the extent of £30,000, in accordance with the provisions of Sections 9 and 19 of the Company's Act, 1907.

By order of the Directors,
BENJAMIN GREEN,
Secretary.

Offices and Works:
Western Road, Mitcham,
Feb. 1, 1910.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors will be held at the Company's Offices, No. 5, Great Winchester Street, Old Broad Street, in the City of London, on Friday, the 25th of February, 1910, at Two o'clock p.m., precisely, to receive the Report of the Directors and the Accounts of the Company for the Half Year ended the 31st of December, 1909; to declare Dividends; to elect Two Directors; to appoint a Special Auditor; and for other Purposes.

The TRANSFER BOOKS of the Company WILL BE CLOSED from the 12th to the 25th of February, both days inclusive.

ERNEST L. BURTON,
Secretary.

5, Great Winchester Street,
Old Broad Street, London, E.C.,
Feb. 7, 1910.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Offices of the Company, No. 63, Chancery Lane, in the County of London, on Friday, the 18th day of February, 1910, at Half-past Three o'clock in the Afternoon precisely, to receive the Report of the Directors and the Accounts for the Half Year ended the 31st of December last; to declare Dividends; elect Two Directors and an Auditor; and to transact the Business of an Ordinary General Meeting.

The TRANSFER BOOKS WILL BE CLOSED from the 4th to the 18th of February, both days inclusive.

By order of the Board,
WILLIAM E. ROBERTS,
Secretary.

Offices: 63, Chancery Lane, W.C.,
Feb. 3, 1910.

ENFIELD GAS COMPANY.

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at the Offices of the Company, Sydney Road, Enfield, on Thursday, the 24th day of February inst., at Five-Thirty o'clock in the Afternoon precisely, to receive the report of the Directors and the accounts of the Company for the Half Year ended the 31st of December last; to declare a Dividend; elect Directors, Chairman, and an Auditor; and to Transact the General Business of the Company.

The TRANSFER BOOKS WILL BE CLOSED from the 11th to the 24th of February, both inclusive.

By order,
CHAS. W. OFFORD,
General Manager and Secretary.

Enfield, Feb. 1, 1910.

BROMLEY AND CRAYS GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the Company's Offices, 156, High Street, Bromley, Kent, on Tuesday, the 22nd day of February, 1910, at Six o'clock p.m. precisely, to receive the Report of the Directors; the Balance-Sheet certified by the Auditors; to declare a Dividend; to determine the Amount of the Auditors' Remuneration; to elect Three Directors and an Auditor, on retirements by rotation; and to Transact generally the Business of a General Meeting.

The TRANSFER BOOKS WILL BE CLOSED from the 7th of February to the 22nd of February, both days inclusive.

By order of the Board.
HENRY W. AMOS,
Secretary.

Offices: 156, High Street,
Bromley, Kent, Feb. 5, 1910.

BARNET DISTRICT GAS AND WATER COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of the above Company will be held at the Holborn Restaurant, 218, High Holborn, London, W.C., on Monday, the 28th day of February, 1910, at Three o'clock in the Afternoon precisely, to receive the Report of the Directors and the Accounts for the Half Year ended the 31st day of December last; to declare a Dividend; to elect Directors and an Auditor, in the place of those retiring by rotation; and to Transact the General Business of the Company.

The TRANSFER BOOKS WILL BE CLOSED from the 15th to the 28th of February, both inclusive.

By order of the Board,
ERNEST W. DREW,
Secretary.

Offices: 6 & 7, Queen Street,
Cheapside, London, Feb. 4, 1910.

RIDDINGS DISTRICT GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY MEETING of the Shareholders of the above Company will be held at the Offices of the Company, Nos. 6 & 7, Queen Street, Cheapside, in the City of London, on Monday, the 28th day of February, 1910, at Four o'clock in the Afternoon, to receive the Report of the Directors and the Accounts for the Half Year ended the 31st day of December last; to declare a Dividend; to elect a Director and an Auditor; and to Transact the General Business of the Company.

The TRANSFER BOOKS WILL BE CLOSED from the 15th to the 28th inst., both inclusive.

By order of the Board,
ERNEST W. DREW,
Secretary.

Offices: 6 & 7, Queen Street,
Cheapside, London, Feb. 4, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
NORTH MIDDLESEX GAS COMPANY.

NEW ISSUE OF £7500 FIVE PER CENT. PREFERENCE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Feb. 15, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHGATE AND DISTRICT GAS COMPANY.

NEW ISSUE OF £5000 FIVE PER CENT. PREFERENCE STOCK,
AND
£2500 SEVEN PER CENT. MAXIMUM DIVIDEND ORDINARY STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Feb. 15, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY.

NEW ISSUE OF £4000 FIVE PER CENT. "C" CONSOLIDATED STOCK.
AND
£4000 FOUR PER CENT. CONSOLIDATED PREFERENCE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Feb. 15, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
HORNSEY GAS COMPANY.

NEW ISSUE OF £5000 CONSOLIDATED STOCK, £6500 FIVE PER CENT. PREFERENCE STOCK,
AND
£3000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, March 1, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTH ESSEX WATER-WORKS COMPANY.

ISSUE OF £20,000 NEW CAPITAL, COMPRISIN £5000 FIVE PER CENT. MAXIMUM ORDINARY STOCK,
£10,000 FIVE PER CENT. PREFERENCE STOCK,
AND
£5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

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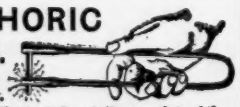

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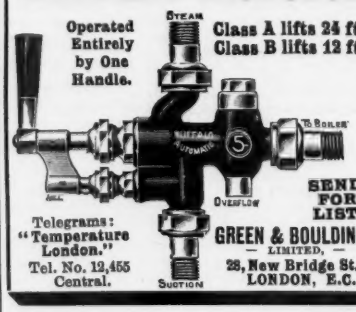

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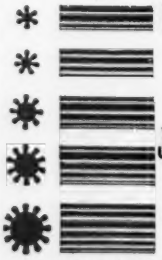

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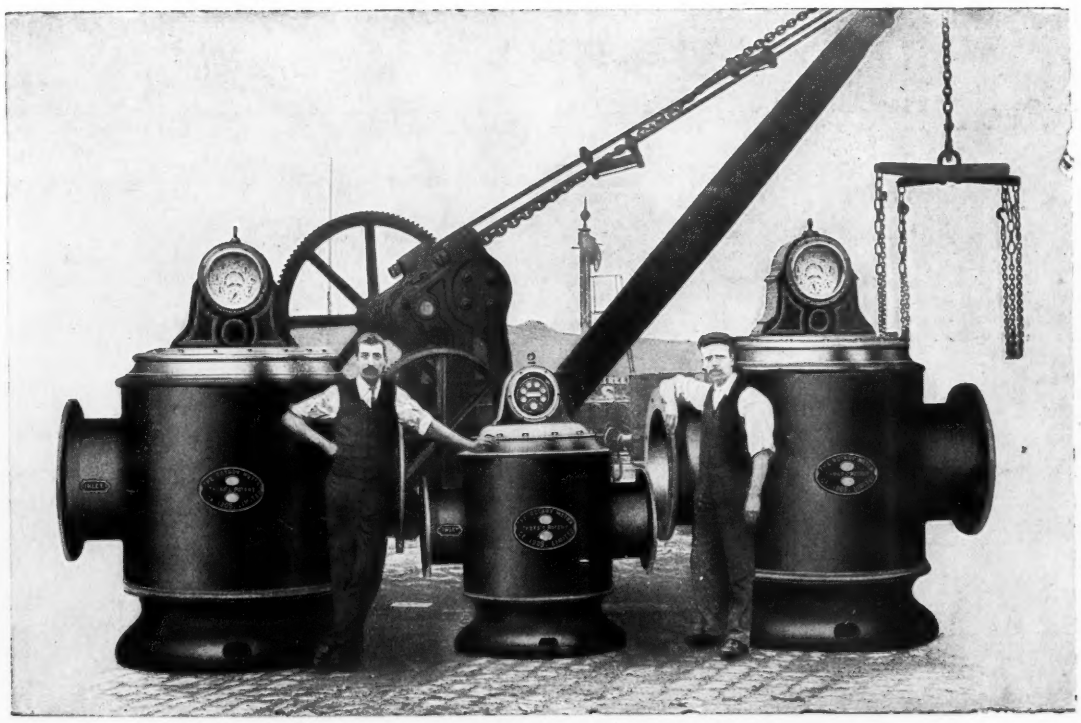

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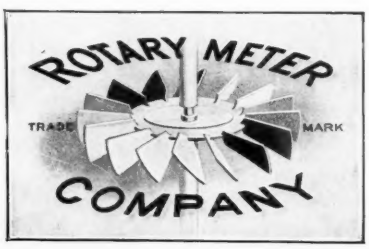
They have received orders for Rotary Station Meters, the aggregate capacity of which totals

One Million, Nine Hundred and One Thousand, Five Hundred cubic feet per Hour

(1,901,500 CUB. FT. PER HOUR).

All of which orders are from operators already having Rotary Meters in service.



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We have now manufactured Rotary Station Meters of an aggregate capacity of

Twelve Million, Two Hundred and Forty-Seven Thousand, Eight Hundred cubic feet per Hour

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SUPPLIED TO 283 GAS-WORKS.

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4. **Accurate Regulation of the Air Supply.**
5. Burners will be supplied either with Gas Adjuster or Automatic Gas Regulator.
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From Lamps with more than one burner, the injectors can be removed from the outside, without taking the lamps to pieces.

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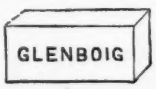

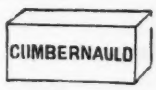

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Undernoted we give a Table of Analysis and Physical Characteristics of a sample of Glenboig Fire-Clay by J. T. Norman, London; and, in submitting a report from a responsible and reliable public analyst, we would here draw attention to the unreliable character of some recently published analyses where a manufacturer selects not only his own samples, but also those of his competitor, and has them treated by a private analyst. SUCH STATEMENTS ARE ALTOGETHER UNTRUSTWORTHY.

ANALYSIS OF GLENBOIG FIRE-CLAY.

By JOHN T. NORMAN, Esq., F.C.S., &c., The City Central Laboratory, LONDON.

THE GLENBOIG UNION FIRE-CLAY CO., LTD., GLENBOIG, SCOTLAND.

23, LEADENHALL STREET,
LONDON, E.C., September 21st, 1909.

DEAR SIRS,

I have completed the investigation of the samples of Clay received from you on the 10th inst., and now beg to report the results.

CHEMICAL ANALYSIS.

	Raw.	Fired.
Silica, free	3·03	3·49
Silica, combined	43·20	49·77
Alumina	36·55	42·10
Ferric oxide	1·80	2·08
Titanic oxide	1·30	1·50
Lime	trace	trace
Magnesia	trace	trace
Alkaline oxides	trace	trace
Sulphates as trioxides	0·92	1·06
Loss on Ignition	13·20	—
	100·00	100·00

PHYSICAL RESULTS.

Density	2·65
Volume weight	1·90
Porosity	15·4 %
Linear shrinkage at 1002° C.	3·70 %
" " " 1050° C.	4·76 %
" " Total	8·46 %
Volume shrinkage at 1002° C.	10·7 %
" " " 1050° C.	12·6 %
" " Total	23·3 %
Plasticity	20·0 %
Fire Stability	1850° C. equiv. to 3362° F. (SEGER CONE 36.) (New Scale CONE 36.

(Signed) J. T. NORMAN.

This Clay is remarkable for its high percentage of Alumina and for the almost complete absence of ingredients tending to lower the refractory properties; its fire stability is extremely high. For some years past I have been urging clients who are working the Clays of the Coal Measures to search for such a material, but you are the first to discover a supply. The possession of this Clay places you in a unique position amongst the manufacturers of refractory goods throughout the world, and I have no doubt will, if duly exploited, enable you to drive out of the market the large quantities of foreign fire-bricks which are being poured into this country for use in the construction of bye-product ovens and for other purposes.—I am, yours faithfully,

JOHN T. NORMAN.

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High Grade Silica Bricks and Blocks for Combustion Chambers and Special Work.

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For CLEANING GAS STOVES

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method for dealing with this perplexing problem.

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SLIP OF GAS IMPOSSIBLE OWING TO OUR PATENT TELESCOPIC SLIDING JOINT

BUNDLES EASILY ACCESSIBLE FOR CLEANING.

"Whessoe" Twin Rotary Washer-Scrubber (Patent No. 24,110 of 1903). Combined capacity 3,000,000 cub. ft. per diem, as supplied to The Walker and Wallsend Gas Company, Newcastle-on-Tyne.

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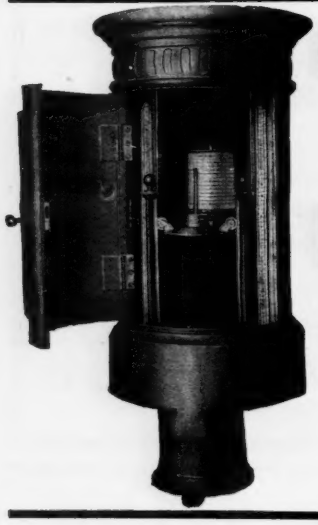
RADIATE MORE HEAT

BY USING

SILCO BRICK RETORTS.

SILCO BRICKS prevent all settling of setting.

SILICA BRICKS for Combustion Chambers, any shape.



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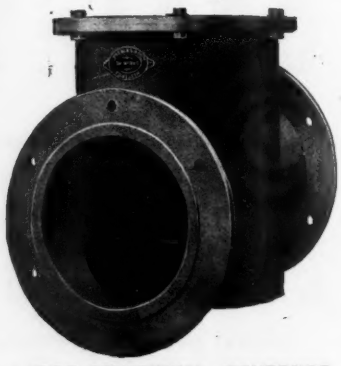
DISTRICT GOVERNOR

FOR

Ordinary or High Pressure.

PILLAR BOX contains Air-Pressure Holder for Loading the Governor from a distance also Recording Gauge and Inlet and Outlet Pressure Gauges.



LARGE MERCURIAL GOVERNOR.
From a Photo. of 24 in. Size.
May be Loaded by Weights or Air Pressure from a Distance.

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HAVE BEEN APPOINTED SOLE MAKERS OF THE

K. & A. WATER-GAS PLANTS.

HIGHEST RESULTS GUARANTEED.

A Number of Installations now Working.

KRAMERS & AARTS PATENTS.

Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

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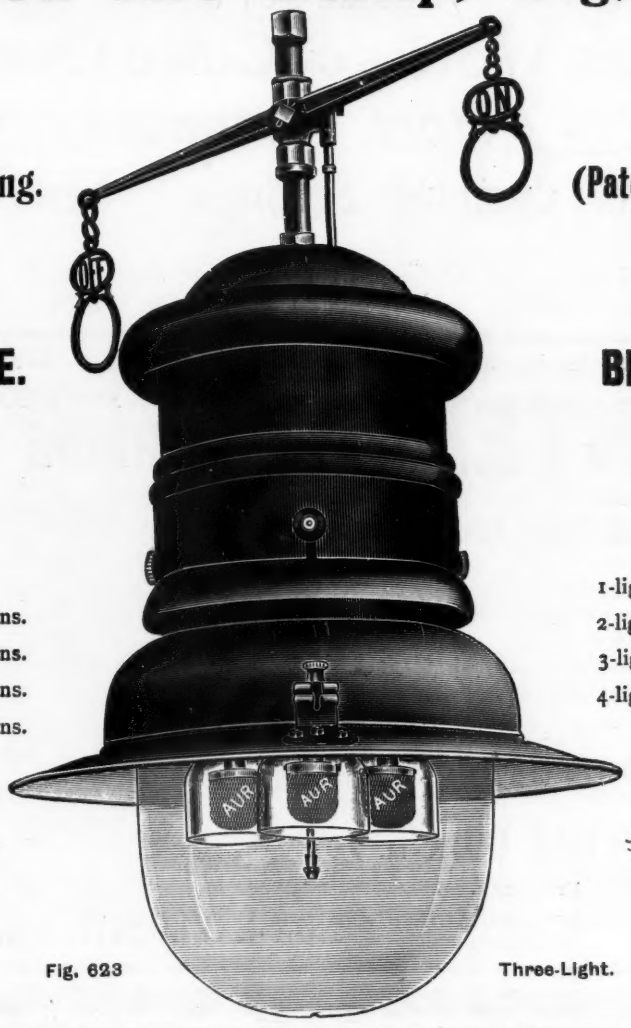

Fig. 623 Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**
Case contains . .	*80*	*18*	*18*	*12*

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra "	**3/6**	**6/-**	**7/6**	Not made

Welsbach Mantles, each **6d.** subject as usual.

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

THE WELSBACH INCANDESCENT GAS LIGHT CO., LTD.,
Welsbach House, 344-354, Gray's Inn Road, London, W.C.

Telegrams and Cables: "WELSBACH LONDON." *Telephone 3410 NORTH.*

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MANUFACTURERS OF
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GLAZED BRICKS AND PORCELAIN BATHS.

Rheinische Chamotte-und Dinas-Werke, Cologne on Rhine.

Construction of

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Retort Furnaces,

Furnaces for Chamber Settings (*Patent*), **New Coke Ovens** (*Patent*),

With and without Recovery of the Bye-Products, Tar and Benzol Distilleries, Ammonia Works, and Cyanogen Extraction Plants.

The Outcome of a Practical Gas Engineer's Life Experience.

THE CENTENARY PETROL GAS TURBINE GENERATOR.

FOR
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Villages,
Mansions,
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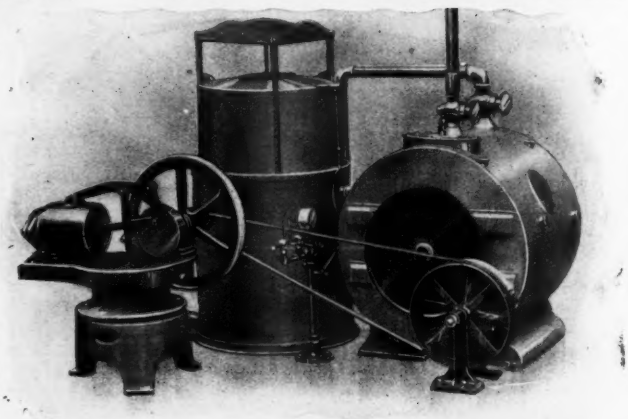
Churches, Schools,
Railway Stations,
County Lighting Districts.

Plants from 100 cub. ft. per hour up to 50,000 cub. ft. per hour for Gas Works.



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109, HOPE STREET, GLASGOW. 11, QUEEN VICTORIA STREET, LONDON.

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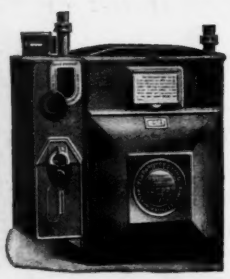

SLOT METER.

DRY METER.

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IMMEDIATE DELIVERY FROM STOCK.
UNBREAKABLE.
EASILY ERECTED. LIGHT FOR SHIPMENT.

Capacity, 9600 Galls. *Size, 16 × 12 × 8 ft. deep.*

PATENT PRESSED STEEL TANKS.

MADE FROM FLANGED PLATES 4 FT. SQUARE.
ANY CAPACITY IN MULTIPLES
OF 4 FT. LENGTH, WIDTH, OR DEPTH.

HUMPHREYS & GLASGOW'S CARBURETTED WATER-GAS PLANTS.
Aggregate capacity of Plants supplied, 228,600,000 cubic feet daily.

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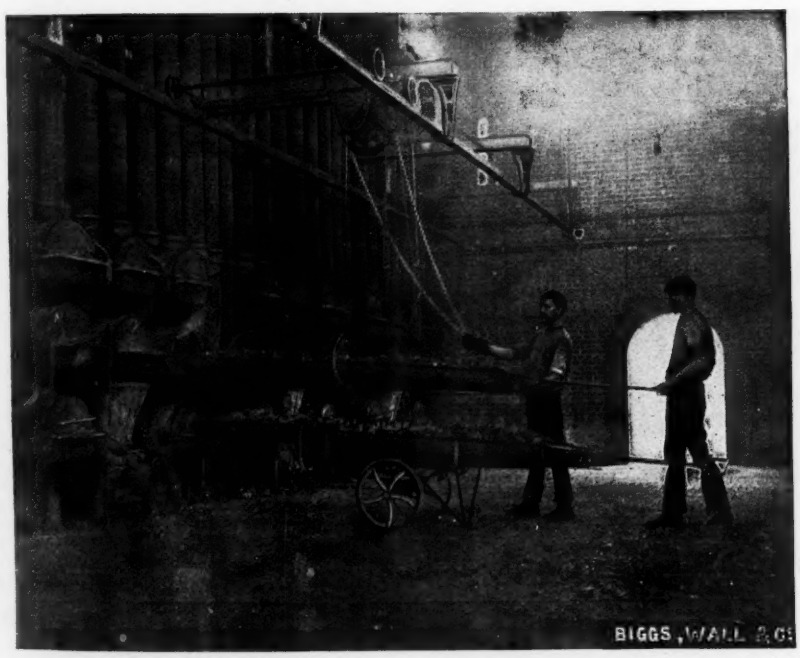
SIMPLE AND INEXPENSIVE.



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Every Skein of equal weight and length.
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THE STRONGEST AND BEST PREVENTIVE AGAINST THEFTS FROM SLOT METERS.

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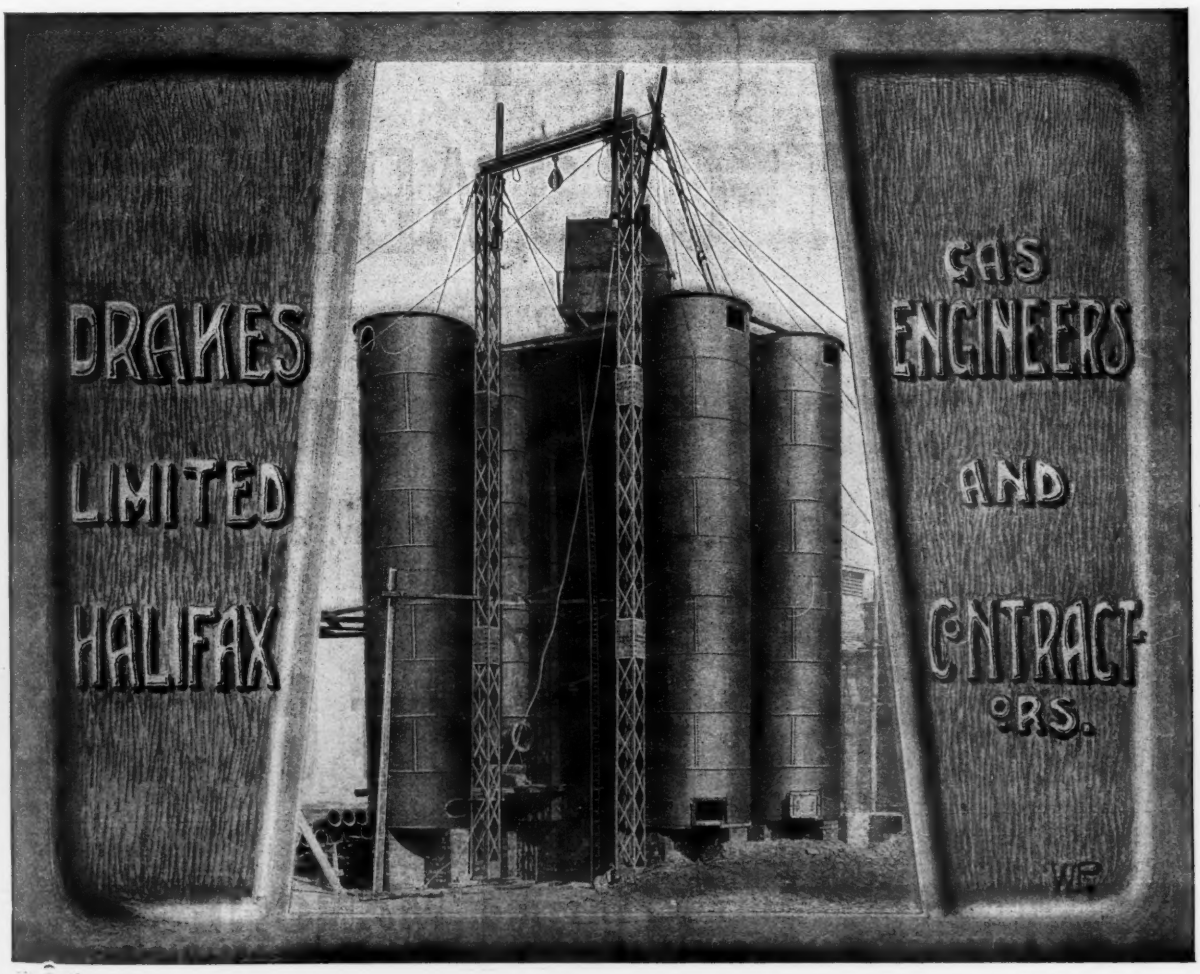

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Printed and Published by WALTER KING, at No. 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Feb. 8, 1910.